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Linking people and activities through community mobility: an international comparison of the mobility patterns of older drivers and non-drivers

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Declaration of Author Contributions

All authors contributed to the development of the research questions, design of the study, collecting data and overseeing data collection with research assistants and reviewing and commenting on drafts of the analyses, and then drafts of the paper. PH and CU drafted and led the ethics application, and each author subsequently managed this process at their institution. CU and AT undertook the data analyses and prepared the initial draft of the paper. All authors contributed to subsequent drafts of the manuscript.

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ABSTRACT

Community mobility using private and public transportation is important for maintaining health, social participation and living well in later life. This international cross-sectional cohort study (n=246) reported on the health and driving status of older adults from seven

countries where the mobility patterns of drivers and non-drivers were compared in terms of city and rural areas, weather, as well as their respective differences in the number of out-of-home places accessed and quality of life. Older adults participated in a semi-structured interview and completed four standardised instruments: the EQ-5D-5L, modified PULSES health profile, modified Transportation Questionnaire, and the Transport - Participation in Activities and Places Outside the Home. Results suggested inclement weather and place of residence negatively impacted out-of-home activities but did not increase use of public transportation. Drivers accessed more out-of-home activities than non-drivers suggesting higher community participation among this group, and quality of life was generally high among all participants, but slightly higher for drivers. Findings indicate that a complex myriad of factors can influence community mobility in older adults and further investigations are needed to understand patterns of transport in later life, particularly with regard to those factors that promote and maintain transport mobility, and relationships between transport mobility, community participation and quality of life.

KEYWORDS

Older adults, transportation mobility, community activities, participation, automobile driving

Introduction

As our global population ages, both the number and percentage of people aged 65 years and older continues to rise (Centers for Disease Control and Prevention & National Center for Health Statistics, 2018; Organisation for Economic Co-operation and Development, 2011). Research on factors that can support older adults' engagement in meaningful social and community activities, at valued destinations is critically needed. For

the purposes of this paper, meaningful activities are defined as those of significance to the individual, and valued destinations are defined as places that are highly regarded and important (Christiansen and Townsend, 2014; Taylor 2017). Having a driver's license is one factor that has been linked to both identity and autonomy in older adulthood (Vrkljan and Polgar 2007). As many daily occupations, or meaningful activities, occur across a broad spectrum of geographical locations, older adults need community mobility strategies in place to ensure continued access to these activities, which can promote wellness in later life (Dickerson *et al*. 2019; O'Neill *et al.* 2019). While transportation access is vital, O'Neill et al. (2019) assert this social determinant of health is one of the most neglected in both research and policy. Multiple studies demonstrate the strong relationship between community mobility in older adulthood in terms of physical and psychological health, engaging in social activities and quality of life (Choi, Lohman and Mezuk 2014; Metz, 2000; Yeom, Fleury and Keller 2008; Zeitler and Buys 2015). Many countries have taken active steps to improve community mobility options for older adults such as low or no fares for public transport, dial-a-ride rural bus services, and ensuring a combination of travel options are readily available (Hagan 2019; Krishnasamy, Unsworth and Howie 2011; Lynott et al 2009; Tuller et al 2010). Across this paper, we investigate community mobility in its broadest sense, encompassing transportation by private (car) or public methods (taxi, bus, rail), as well as by walking, and, as such, the terms community mobility, or transportation mobility are used interchangeably.

Promoting community mobility is essential to supporting ageing in place. The concept of ageing in place (Ahn, Kwoon, and Kang, 2020; Golant and LaGreca, 1994; Martin, Long and Kessler, 2019; Sixsmith and Sixsmith, 2008) has garnered international attention over the past three decades not only because of economic pragmatics, but because it

supports people to remain in environments with established proximity to services and social networks, including family and friends. Active ageing enables older adults to continue to live meaningful and fulfilling lives and contribute positively to society, which has been linked to health and human service savings (World Health Organization 2015). Papageorgiou, Marquis, and Dare (2016) explored facilitators and barriers to community participation among older adults and found the desire to maintain or even create new social relationships had a strong influence on community participation. Routines and habits individuals established earlier in life motivated them to maintain engagement in activities as they aged, while a desire to develop new interests also facilitated involvement in the community. However, transportation plays a critical role when it comes to enabling older adults to get to these activities and maintain their community involvement. Chao (2018) described transport planning as one of the pillars of urban planning and further identified public transport and facilitation of private vehicle use in later life as the two key components that enable older adults to remain connected in their communities and to age in their place of choice.

Vrkljan, Leuty, and Law (2011) and Wiles *et al.* (2012) both reported that ageing in place was linked to one's sense of identity in terms of their independence and autonomy, and that transportation accessibility, availability and affordability, particularly public transportation, was an enabler for ageing in place. Similarly, Gardner's (2014) ethnographic study found a complex array of factors can influence community mobility in later life. From this study, key motivators for maintaining community mobility included the preservation of identity and the need for social interaction, and as such, individually tailored solutions are often required to maintain out-of-home mobility. Hagan (2019) even argued that a rural dial-a-ride bus service was itself a place for informal socialising, coming in as a third place and following 'home' and 'shopping/dutiful visits/appointment'. This accessible form of

transport was found to support ageing in one's local community, as older adults could both socialise as well as receive valued transport to address isolation. Conversely, several factors have been identified as negatively associated with community mobility, including traffic congestion and lack of available seating on public transport (Krishnasamy, Unsworth and Howie 2013), recent hospitalisation (Loyd et al 2018), weather (Smith *et al.* 2016), gender (Choi *et al.* 2015; Fristedt *et al.* 2014), and urban versus rural living (Mattson 2011). When referring to weather, this paper uses the terms 'good' and 'inclement' where the latter encompasses both extreme heat as well as extreme cold, rainy, icy, and/or snowy conditions.

Driving is also crucial for many people to age in place, as it is often the most convenient option for personal transportation and supports community participation. Zeitler and Buys (2015) used GPS and in-depth interviews to track the community mobility of 13 people living in city and suburban environments in Australia; areas not well-served by public transport. Key findings suggested older adults needed to reach a variety of destinations across the city to engage in their daily occupations and preferred the flexibility car travel offered; that driving supported other older adults in the same social circle; and that a significant advantage of car travel was the ability to transport both goods and other people. Much research has focused on medically at-risk older drivers, where driving assessment, driving cessation and transitions to non-driving have been investigated (Choi, Adams and Kahana 2012; Dickerson *et al.* 2019; Liddle *et al.* 2012; Rapoport *et al*. 2013; Stapleton, Connolly and O'Neill 2015; Unsworth *et al.* 2012). Findings in this area highlight that it is not age per se that may impact continued driving, rather it is the impact of medical conditions and other functional declines that can affect sensory, cognitive and physical abilities needed for safe driving (Levasseur *et al.* 2015; Mazer *et al.* 2016). Most older adults

prefer to retain their ability to drive for as long as possible and their personal automobile remains their primary mode of transport (Mazer *et al.* 2016; Turcotte 2012; Zeitler and Buys 2015). As such, many older drivers use self-regulatory strategies including adjusting where and when they get behind-the-wheel, making fewer and shorter trips in peak traffic, at dusk and at night, and not driving during inclement weather (Koppel *et al.* 2016; Levasseur *et al.* 2015; O'Neill *et al.* 2019; Rapoport *et al.* 2013; Unsworth *et al.* 2007). Not driving in inclement weather is of particular interest, as there are few studies that have examined if older adults replace driving with other forms of transport due to more challenging weather conditions, or simply don't go out at all. In addition, some of these self-regulation strategies are matched by progressive legislation in certain jurisdictions that allows for temporal and geographically restricted driving options as a method of enabling continued, albeit restricted, driving for as long as possible (Road Safety Authority 2019; Austroads and National Transport Commission 2016). Nevertheless, driving cessation is inevitable, with research suggesting that men will have approximately 6 years, and women will have an average of 10 years of dependency on alternative modes of transportation beyond their personal automobile (Foley *et al.*2002). Hence, access to and utilisation of public transportation among older adults requires investigation. Older adults who have never driven or who need to stop driving may need to rely on public transport systems, friends and family, or other modes to enable continued social connectedness and being able to age in place in their local communities. These alternative transport options should be safe, affordable and accessible.

Given the ageing of populations globally, research is critically needed to examine how support for transportation options in older adulthood can impact community participation. This study stems from an international collaboration (Vaucher *et al.* 2017)

investigating the broad relationship between community transportation mobility, out-of-home participation and living well among older adults. The research in this paper examined the mobility patterns of older adults in different countries and differences in out-of-home activities and quality of life between older adults who are still driving and those who are no longer driving or never drove. Specifically, the aims of this research examined (i) demographic factors such as age and gender, health status and driving status among older adults from seven countries, (ii) the impact of age, gender, weather, time of day, road type, traffic volume and city versus rural location on driving patterns of older drivers, and avoidance of any particular driving conditions, (iii) the types of transportation used by older drivers and non-drivers to access out-of-home places and any differences between these groups in terms of the places accessed, and (iv) if there are any differences between drivers and non-drivers on measures of quality of life and satisfaction with life.

Methods

Study design

A cross-sectional cohort design using data collected in seven countries: Australia, Canada, England, Ireland, South Africa, Switzerland and United States of America. The research was conducted according to the World Medical Association Declaration of Helsinki. The lead institution who reviewed the Ethics proposal was Brunel University London. Each researcher obtained ethical approval from their academic institution to conduct the study and a data transfer agreement was signed and approved by the ethics committees.

Participants

To participate in the study, individuals were aged 65 years or older, community dwelling (not living in a residential aged care facility) and able to speak the native language of the interviewers or translator in countries where available. Convenience sampling was used to recruit participants via flyers placed at community facilities, through general medical practitioners and from participants from other research projects who indicated they were agreeable to be contacted about future studies. Interested individuals who met these criteria contacted the local research team and were provided with written information about the study. Those who agreed to participate were asked to sign a written consent form or provide informed verbal consent at the start of the interview.

Measures

A semi-structured interview and four standardised measures were administered in this research. The semi-structured interview recorded the participant's responses to a standard sequence of questions that gathered information such as age, gender, living environment, work status, mobility aid status and current driving status. No personally identifying data were gathered. The EQ-5D-5L (Herdman et al. 2011), modified PULSES health profile (Granger, Albrecht and Hamilton 1979), modified Transportation Questionnaire (Dahan-Oliel *et al.* 2010) and modified Participation in Activities and Places Outside the Home (ACT-OUT) (Margot-Cattin *et al.* 2019) were all administered.

The EQ-5D-5L is a patient reported outcome measure of health-related quality of life comprising five dimensions including mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension is evaluated on a five-level response scale (level 1=no problem to level 5= extreme problem). It also includes a visual analogue scale

recording the participants' current overall health related quality of life, with 100 representing the best health state while 0 represents the worst.

The modified PULSES profile records functional ability across six categories: physical condition (P), upper limb function (U), lower limb function (L), sensory components (S), excretory functions (E), and support factors (S) and is scored from 1 to 4 with 1 representing the best function and 4 the least. These categories can be summed to obtain an overall score from 6 to 24 that reflects overall functional ability.

The Transportation Questionnaire measures frequency of use and satisfaction for different transport modalities including driving, public transport (bus, train), taxi and walking. This measure was modified with the authors' permission to include the frequency of transportation modalities used in both good and inclement weather.

With the permission of the authors we administered a modified version of the Participation in Activities and Places Outside the Home (ACT-OUT) (Margot-Cattin *et al.* 2019). The transportation components of the original ACT OUT were relevant to the aims of this study and the originators subsequently asked that this modified version of ACT-OUT be renamed as Transport - Participation in Activities and Places Outside the Home (T-ACT-OUT). The T-ACT-OUT consisted of partial use of two of the three parts of the original ACT-OUT that were relevant to the current study. The T-ACT-OUT identifies 21 places that individuals typically visit, the frequency of participation and the transportation method people use to visit these places. Places are divided into four clusters: 1. Administrative, and self-care places (e.g., grocery store, hairdresser, bank, post office); 2. Places for medical care (e.g., hospital, dentist, day care); 3. Social, cultural, and spiritual places (e.g., restaurant or cafe, cemetery, entertainment or cultural places); and 4. Places for recreational and physical

activities (e.g., garden; forest, mountain, lake, or seaside; sports facility). Brief questions are also asked in relation to life satisfaction as well as concerns and perceived risks related to being out in the community.

Procedure

A meeting with each participant was arranged during which the semi-structured interview and standardised questionnaires were administered, taking approximately 60-minutes to complete. The meetings were completed by trained interviewers either face to face or via telephone depending on the preference of the individual participant. A standard proforma was used where the interviewer recorded the participant's responses to both interview questions and standardised assessments.

Statistical Analysis

All anonymised data were analysed using IBM SPSS Statistics version 26. Data were checked for normality and adherence to statistical assumptions. For aim 1, demographic data and information from the standardised measures (EQ-5D-5L, Transportation Questionnaire, PULSES and T-ACT-OUT) were summarised using descriptive statistics (means, standard deviations, frequencies and percentages). Differences between participants across countries were analysed using ANOVAs for variables with continuous data (e.g. Age, and Years since stopped work) and Chi square tests for variables with categorical data (e.g. Gender and Living environment). In relation to aim 2, the impact of weather, time of day, road type and traffic volume and city versus rural location, on driving patterns of older drivers were reported descriptively. Using Chi squared analyses, we then investigated any differences in the frequency that drivers used each type of transport between rural and city drivers in good weather, between rural and city drivers during

inclement weather, and the difference between all drivers, in both good and inclement weather. Differences between city and rural drivers were also investigated forlevel of avoidance of a range of driving situations (e.g. night driving) also using Chi square tests. To investigate if gender had an impact on avoidance of certain driving situations, a Chi square test was undertaken, and this statistical test was similarly used to investigate differences between participants in three different age groups (≤73 years, 74-80 years and ≥81 years). For the third aim, the types of transportation used by older drivers and non-drivers to access out-of-home places as collected on the T-ACT-OUT were presented descriptively, and differences between attendance at these places for drivers and non-drivers were investigated using Chi square tests. For the final aim, differences between drivers and non-drivers in terms of health-related quality of life on the EQ-5D-5L-VAS was investigated using a Students t-test, and satisfaction with life on the T-ACT-OUT was investigated using a Chi square test.

RESULTS

Characteristics of participants including age, gender, health status and driving status

Data were collected over an 18-month period between March 2018 and September 2019 with a total of 246 participants. To fulfill the first aim, Table 1 describes participant demographics. Most participants had completed tertiary education (67.9%). The mean age ranged across countries from 73.7 years (SD7.26) in Australia to 80.55 (SD6.33) years in South Africa and, given this age profile, most participants were not working (89.8%) at the time of data collection. A little more than half of the participants lived in a city/urban centre (58.1%). Overall, participants had a mean score of 77.94 (SD15.50) out of 100 on the EQ-5D-5L, (with higher scores indicating better health-related quality of life). Generally,

participants required no assistance with walking (76.7%) and reported an average health profile of 8.08 (SD2.09) out of 24 where lower scores indicate better health. As outlined in Table 1, demographics differed in several areas across countries, except gender, years since stopped work and use of a walking aid. While there were more females than males in the sample (65.4% vs. 34.6%), the difference between genders for each country was not statistically significantly different (p= .670). Most participants indicated they were still driving (82.1%) with few having stopped driving (12.2%) and very few reporting they had never driven (5.7%).

< Insert Table 1 about here >

Impact of age, gender, weather and city versus rural living situation on driving patterns of older drivers

Using a car, as a driver or passenger, or walking were the most frequently reported modes of transportation used by drivers. Table 2 indicates the modes of transportation and frequency of use in good and inclement weather, for both rural and city dwellers. Chi square analyses revealed no differences between rural and city dwellers in good weather in terms of frequency of driving (p=.350), nor travelling as a passenger (p=.281), nor walking (p=.793). Similarly, no differences were found in the frequency of using these modes of transport during inclement weather: driving (p=.881), travelling as a passenger (p=.618), and walking (p=.290). However, when investigating differences in the frequency with which types of transport were used between all drivers (city and rural) in good and inclement weather, it was found that participants drove less frequently (p=.001) and walked less frequently (p=.001) during inclement weather. However, they had similar patterns of frequency for

being a passenger in a car (*p*=.516), and although the sample sizes were too small for analysis, visual inspection of the data also suggests similar patterns of frequency for use of public transport, across good and inclement weather (see table 2). Most rural and city participants reported they never used public transport options (e.g., bus, train or tram), regardless of the weather conditions, perhaps reflective of the high reliance on use of the personal car among participants.

Table 3 outlines the frequency with which drivers avoided certain conditions over the last three months. Drivers were more likely to report avoiding driving at night (28.2%) and driving in inclement weather (25%) than under all other conditions. Chi square analyses investigated if there were any differences between avoiding a range of driving conditions and issues for city versus rural drivers, but none were found (see Table 3). There was also no difference in driving avoidance between the three age groups ≤73 years (38%), 74-80 years (33%) and ≥81 years (29%), (*p*=.125), nor between male and female participants (36.6% and 63.4%), (*p*=.323).

< Insert Tables 2 and 3 about here >

Transport used by older drivers and non-drivers to access out of home places, and differences in places accessed

Table 4 presents the differences between drivers and non-drivers in terms of the T-ACT-OUT places they identified going to, and the modes of transportation used to access these places. The frequency of using public transport to attend out-of-home places, as recorded on the T-ACT-OUT, was generally low for both drivers and non-drivers. The

frequency regarding the type of transportation used to access different locations varied, which may be related to the occupation or activity being completed in the specific location. For example, passenger frequencies were highest for attending a hospital or a transportation hub (depot) and walking frequencies were highest when accessing activities in one's neighbourhood.

Chi square tests demonstrated significant differences between how many locations drivers, as compared to non-drivers, attended out-of-home activities for eight of 21 locations in the T-ACT-OUT; supermarket, pharmacy, bank/post office, family/friends, entertainment, seaside, neighbourhood and sport facilities. In all cases, more drivers recorded attendance at such locations, suggesting a higher level of participation and engagement in the community among these participants. Differences were seen in three of the four clusters of locations of these activities (consumer, administrative, and self-care places; social, cultural, and spiritual places; and places for recreational and physical activities). There were no differences between drivers and non-drivers in places associated with the medical care cluster (i.e., doctor, hospital, therapy and day care), suggesting equal participation in these locations.

< Insert Table 4 about here >

Quality of life and life satisfaction for drivers and non-drivers

There were significant differences in health-related quality of life among participants, with drivers reporting higher levels on the EQ-5D-5L-VAS (M= 79.1, SD 14.9) compared with non-drivers (M=72.47, SD 17.2), (*p*=.011, 95% CI 1.57- 11.71). However,

satisfaction with life was not significantly different between drivers and non-drivers, when investigated with the T-ACT-OUT categories for drivers/ non drivers (p=.802).

Discussion

This research examined the mobility patterns of older drivers and non-drivers from seven countries and documented their out-of-home activities and quality of life. Initially the paper examined demographic factors, such as age and gender, health status and driving status, across participants. Although some differences between participants from different countries were identified, this research, as well as the research from others (Choi *et al.* 2012; Gardner 2014) suggests a complex mosaic of factors combine to impact community mobility. As such, our research team determined investigating associated activity patterns across participants in an international sample as more valuable than examining relationships according to country per se. The second aim related to exploring the impact of age, gender, weather, time of day, road type, traffic volume and city versus rural location on driving patterns of older drivers, and avoidance of particular driving conditions. Our findings suggested weather was a major factor impacting access to out-of-home activities. All drivers (living in rural and city areas) drove less frequently and walked less frequently in inclement weather but their use of public transport did not increase in this weather. In terms of the types of transportation used by older drivers and non-drivers to access out-of-home places, we found that driving was the most common form of transport, and that drivers were accessing many more out of home places and activities than non-drivers. The final aim of the study was to investigate if there were any differences between drivers and non-drivers on two measures of quality of life. The findings showed that quality of life was

generally high among all participants, but slightly higher for drivers when compared to non-drivers. However, given that only a small difference between the groups was identified for only one of the measures, this finding requires further investigation.

Characteristics of participants from seven countries

The participants in this research were from seven countries, and although the samples were generally well-educated and self-identified as relatively healthy, there were several notable differences. There was a higher proportion of participants in Canada who were urban dwellers compared to those recruited from the United States, Ireland and England who were predominantly from rural areas; the proportion of participants in Ireland without a tertiary qualification was higher than in other countries, and the Irish population also reported the lowest quality of life on the EQ-5D-5L. Most of the participants in Ireland were drivers, which may be reflective that a high proportion were rural dwellers, and there were also higher proportions of participants from Canada and the USA who were drivers when compared to England and Switzerland. Further investigations comparing non-drivers with drivers from different countries were not possible as sample sizes of non-drivers were not sufficiently large. As noted above, while the findings suggest a need to cross-compare differences in countries in future research, it was valuable to analyse our data for drivers and non-drivers, across the seven countries (Choi *et al.* 2012; Gardner 2014).

Relationship between mode of transportation on age, gender, weather and location and participation in community activities

Similar to Vrkljan, Leuty, and Law (2011) and Hagan (2019) who all identified the important role of transportation on the ability of older adults to age-in-place, findings from the current study also support the notion of transportation as an enabler of living well in later life. Our analysis indicated 82% of our sample, which was comprised of community-dwelling older adults, were still driving. Passenger frequencies were highest, however, when participants needed to access hospital services, or transport hubs (depots), which was also identified by Vrkljan, Leuty and Law. As raised by Gardner (2014), the reason a driver might choose to use their own vehicle, public transport or be a passenger, is often complex and for a myriad of purposes. The results from the T-ACT-OUT suggested more drivers, as compared to non-drivers, were accessing a wide variety of places, such as the supermarket, entertainment, pharmacies, bank/post-office, municipal offices, therapy, visiting the seaside or forest, their own neighbourhood, sporting facilities as well as visiting with friends and family. Hence this research indicates that being a driver, across all represented countries, can support greater community participation and engagement in a range of out-of-home activities. This finding resonates with recent evidence, which suggests supporting older drivers to continue to drive for as long as possible to maintain access to their communities is critical (O'Neill *et al.* 2019). In fact, the findings in Table 4 emphasise that driving, followed by walking and being a passenger in a private vehicle, are the most frequently used transportation options for older adults when it came to the 21 places captured in T-ACT OUT. However, there were a small number of participants who indicated using public transportation, particularly among city dwellers who it is assumed have greater availability of public transportation, which warrants further investigation with larger samples in the future to understand what may promote and support public transportation use in later life. As such, the question remains as to whether low use of public transportation is linked to a

lack of nearby services, or even a reluctance to use existing services, which could be due to fear or other safety-related issues in their neighbourhood (Levasseur *et al.* 2015), or perhaps an over reliance and familiarity with using their private car, as the primary source of transport. As pointed out by Foley *et al.* (2002), many older people are likely to outlive their driving years, therefore in order to maintain their level of out-of-home engagements, the findings from our study indicate a need to address this over-reliance on driving. The findings suggest there is a need to enable older adults to prepare to transition from being drivers to non-drivers and engage more effectively with public transportation options if such options are available, to support living well in later life.

The results on the Transportation Questionnaire also indicated drivers reduced or avoided driving in inclement weather, which may indicate good levels of self-awareness and self-regulation regarding driving patterns. However, these participants did not increase their use of public transport in such conditions, which suggests they simply remain at home. A GPS-based analysis conducted by Smith *et al.* (2016) of older Canadian drivers found they took shorter trips during the winter months. However, unexpectedly, they also reported that these older drivers also took longer trips at night, even when controlling for weather conditions. Similarly, in our study, 71.8% of participants rarely or never reduced their frequency of night driving. All these research findings suggest that a complex myriad of factors is at play regarding the driving patterns and community engagement of older people. Smith et al. suggested city planners and traffic engineers consider that if older drivers are using roadways at night and during inclement weather, they should improve signage, maintenance including snow clearing and streetlights, and this would support the safety of all road users. Findings from the current study also support the need to increase the

accessibility of public transport as an alternative to the private automobile for older people to maintain access to their out-of-home activities, even in poor weather.

Quality of life and life satisfaction for drivers and non-drivers

The final research aim related to exploring differences in quality of life and life satisfaction between study participants who did and did not drive. Our research, as well as other research evidence and commentaries highlight the critical role of transportation on quality of life and life satisfaction in older adulthood (O'Neill *et al.* 2019; Rantakokko *et al.* 2013; Zeitland and Buys 2015). However, while our findings on the EQ-5D-5L-VAS showed a statistically significant difference between drivers and non-drivers, the mean difference was only 6.6 points, which on a scale of 100 points is potentially not clinically meaningful. Unfortunately, we could not locate any prior studies reporting EQ-5D-5L-VAS scores for drivers versus non-drivers, necessitating future data collection using this measure. When overall quality of life was measured on the four level Likert-type scale on the T-ACT-OUT, there were no differences between drivers and non-drivers. This finding, coupled with the small difference between drivers and non-drivers on the EQ-5D-5L-VAS, suggests most older adults in the current study are still able to do what they expect and want to do, but that further investigations regarding any differences in quality of life between older drivers and non-drivers are required.

Limitations

This research presents insights into the patterns of transport use by older people across seven countries, however, several limitations must be acknowledged. The convenience sampling strategy meant participants represented a relatively well and active group of older people, the majority of whom drove. The smaller sample size for non-drivers

limited our ability to examine between country differences between these groups. In addition, research using semi-structured interviews are subject to a range of limitations, including participant responses being affected by the season of data collection. For example, if interviews were conducted in summer, it may be more difficult for people to report on transport use in the winter. The income status of participants was also not collected in this study given the difficulties associated with capturing accurate, ethical, meaningful, yet non-invasive data on this measure across the seven countries involved. In the future, such data could be used to determine if transportation access and associated activity involvement and life satisfaction is linked to income status, and if further interventions can redress any inequities found. In addition, we did not collect data on whether participants lived with a partner or spouse (and that person's driving status) and acknowledge that future studies could gather more detailed data on the circle of people around the participant and how the number, relationship, transport access and geographical proximity of these people influence transport patterns. Cross country comparisons were not possible on each variable, as not all locations used all forms of transport (e.g., light rail). In addition, some definitions on the T-ACT-OUT require further refinement regarding language used, as terms such as "bad weather" have particular contextual meaning for some countries. For example, countries with more severe winters (e.g. Canada, Switzerland) may have perceived this terminology differently from those with very hot weather conditions, such as South Africa or Australia, where heat may not have been associated as "bad weather". Finally, while the data sets were complete in most countries, the South African data collection was limited with only sections of the demographics, Transportation Questionnaire and T-ACT-OUT administered. Future studies should consider adopting more representative sampling techniques and, for

certain variables, such as socioeconomic status, incorporate strategies using other databases or census data.

Conclusions

This study is first to our knowledge to collect data from community-dwelling older adults from seven countries to examine patterns of transport and out-of-home activities with a focus on differences between drivers and non-drivers. While our analyses found weather was a major factor that impacted out-of-home activities, use of public transportation did not increase under inclement weather conditions, suggesting further attention be paid to make public transportation more accessible to people when the weather makes it more challenging to go out. Drivers in our study were accessing many more out of home places and activities than non-drivers, suggesting higher community participation among those who were driving. This finding is congruent with the findings of other international studies that call for programs that support older people to drive safely for longer (Sangrar *et al.* 2019). Finally, this research found that quality of life was generally high among all participants, but slightly higher for drivers when compared to non-drivers. Since many studies have shown that quality of life and life satisfaction are impacted by access to safe transportation, research, policy and practice should focus on developing strategies that assist older people to maintain transport and, in turn, their access to out-of-home activities. Given the complexity of mobility patterns and use of transport, an individualised approach may be necessary to support older adults transition from driving to driving cessation by using modes of transport that keep them connected to their community regardless of their age, ability and where they live.

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Table 1: Characteristics of participants by country (*n*=246)

Characteristic		Australia (*n*=40)	Canada (*n*=44)	England (*n*=19)	Ireland (*n*=40)	South Africa (*n*=40)	Switzerland (*n*=20)	USA (*n*=43)	*P* values[1]
Age M(SD)	76.75(7.35)	73.70(7.26)	80.27(6.97)	76.65(10.22)	74.30(5.76)	80.55(6.33)	77.65(5.23)	74.35(6.76)	<.001
Gender Freq *n*(%)									
Male	85(34.6)	13(32.5)	20(45.5)	5(26.3)	13(32.5)	13(32.5)	5(25.0)	16(37.2)	.670
Female	161(65.4)	27(67.5)	24(54.5)	14(73.7)	27(67.5)	27(67.5)	15(75.0)	27(62.8)	
Living Environment Freq *n*(%)									
Rural	103(41.9)	17(42.5)	6(13.6)	18(94.7)	27(67.5)	0	6(30.0)	29(67.4)	<.001
City	143(58.1)	23(57.5)	38(86.4)	1(5.3)	13(32.5)	40(100.0)	14(70.0)	14(32.6)	
Work Status Freq *n*(%)									
Working	25(10.2)	8(20.0)	4(9.1)	3(15.8)	1(2.5)	0	0	5(12.0)	.003
Not working	220(89.8)	32(80.0)	40(90.0)	16(84.2)	39(97.5)	40(100.0)	20(100.0)	37(88.0)	
Years since stopped work M(SD)	16.06(11.34)	18.13(13.62)	17.77(11.09)	13.27(8.91)	14.26(10.10)	12.77(9.14)	15.79(7.67)	16.81(13.38)	.547
Education Freq *n*(%)									
No tertiary education	78(32.1)	16(40.0)	9(20.5)	5(27.8)	31(77.5)	8(20.0)	1(5.6)	8(18.6)	<.001
Tertiary educated	165(67.9)	24(60.0)	35(79.5)	13(72.2)	9(22.5)	32(80.0)	17(94.4)	35(81.4)	
Quality of Life EQ5D5L VAS M(SD)	77.94(15.50)	77.65(16.30)	83.86(9.82)	77.22(13.31)	70.00(15.70)	79.35(14.87)	77.25(17.88)	78.84(17.35)	.008
Health Profile PULSES M(SD)	8.08(2.09)	7.75(1.80)	7.07(1.33)	8.42(2.60)	9.18(2.07)	missing	9.65(2.93)	7.51(1.50)	<.001
Walking Aid Freq (%)									
No help	188(76.7)	29(72.5)	38(86.4)	12(63.2)	31(79.5)	28(70.0)	12(60.0)	38(88.4)	.057
Help	57(23.3)	11(27.5)	6(13.6)	7(36.8)	8(20.5)	12(30.0)	8(40.0)	5(11.6)	
Current Driving status Freq (%)									

Driving	202 (82.1)	30 (75.0)	42 (95.5)	12 (63.2)	31 (77.5)	32 (80.0)	13 (65.0)	42 (97.7)	.001
Not Driving	44 (17.9)	10 (25.0)	2 (4.5)	7 (36.8)	9 (22.5)	8 (20.0)	7 (35.0)	1 (2.3)	
Number of years driving M(SD)	55.79 (9.93)	54.77(7.84)	59.29(10.80)	55.00(11.22)	51.16(11.45)	missing	50.78(9,60)	57.73(9.93)	.005
Hours per week driving Freq (%)									
1-4 hours	78(48.1)	13(43.3)	14(33.3)	7(77.8)	14(46.7)	missing	8(66.7)	22(56.4)	
5-10 hours	66(40.7)	17(56.7)	20(47.6)	1(11.1)	14(46.7)		3(25.0)	11(28.2)	
11-15 hours	13(8.0)	0	7(16.7)	0	2(6.6)		1(8.3)	3(7.7)	
16-20 hours	4(2.5)	0	1(2.4)	1(11.1)	0		0	2(5.1)	
21-22 hours	1(.6)	0	0	0	0		0	1(2.6)	

1. *p*-values of difference between countries generated using ANOVAs for variables with continuous data, and Chi square tests for variables with categorical data. M(SD)- Mean (Standard Deviation)

Table 2: Use of different transportation methods in good and inclement weather for drivers in rural and city areas (from modified Transportation Questionnaire)

	Good weather *n ranging from 82 to 117*(%)		**Inclement weather *n*(%)** *n ranging from 81 to 85*(%)		
	RURAL	**CITY**	**RURAL**	**CITY**	***P* values**[1]
Personal car as driver: Frequently	63(75.0)	97(82.9)	36(43.9)	42(49.4)	.350 (a)
Rarely	19(22.6)	19(16.2)	33(40.2)	33(38.8)	.881 (b)
Never	2(2.4)	1(0.9)	13(15.9)	10(11.8)	<.001 (c)
Personal car passenger: Frequently	8(9.5)	18(15.4)	12(14.5)	8(9.4)	.281 (a)
Rarely	45(53.6)	58(49.6)	32(38.6)	43(50.6)	.618 (b)
Never	31(36.9)	41(35.0)	39(47.0)	34(40.0)	.516 (c)
Public transport Bus: Frequently	9(10.6)	2(1.7)	7(8.2)	3(3.5)	N/A
Rarely	17(20.0)	26(22.2)	11(12.9)	19(22.4)	
Never	59(69.4)	89(76.1)	67(78.8)	63(74.1)	
Public transport Train: Frequently	2(2.4)	0	1(1.2)	1(1.2)	N/A
Rarely	19(22.4)	25(21.4)	14(16.5)	22(25.9)	
Never	64(75.3)	92(78.6)	70(82.3)	62(72.9)	
Public transport Tram: Frequently	1(1.2)	3(2.6)	0	3(4.2)	N/A
Rarely	7(8.5)	29(24.8)	6(10.3)	26(36.1)	
Never	74(90.2)	85(72.6)	52(89.7)	43(59.7)	
Private Taxi: Frequently	1(1.2)	2(1.7)	0	0	N/A
Rarely	4(4.9)	26(22.2)	5(6.2)	21(25.0)	
Never	77(93.9)	89(76.1)	76(93.8)	63(75.0)	
Walk: Frequently	48(56.5)	70(59.8)	20(23.5)	22(25.9)	.793 (a)
Rarely	15(17.6)	28(23.9)	22(25.9)	25(29.4)	.290 (b)
Never	22(25.9)	19(16.2)	43(50.6)	38(44.7)	.001 (c)

1.*p*-values generated using Chi square tests. (a) difference between Rural and City drivers in Good weather, (b) difference between Rural and City drivers in Inclement weather, (c) difference between all drivers, in Good and Inclement weather.
N/A- not applicable- does not meet minimum expected cell frequency, therefore unable to calculate.

Table 3: The frequency of drivers avoiding specific driving conditions over the last three months and differences between city versus rural drivers (from modified Transportation Questionnaire) (*n*=202)

	Frequently *n*(%)	Rarely *n*(%)	Never *n*(%)	*P* values[1]
Driving at night	57(28.2)	61(30.2)	84(41.6)	.291
Making right/left turns across traffic	9(4.5)	25(12.4)	168(83.1)	.082
Driving in bad weather	51(25.2)	74(36.6)	77(38.2)	.408
Driving on high traffic roads	34(16.8)	42(20.8)	126(62.4)	.734
Driving in unfamiliar areas	38(18.8)	51(25.3)	113(55.9)	.926
Pass up opportunities to go out because of concerns about driving	7(3.5)	26(12.9)	169(83.7)	.914

1.Chi square test used to generate p-values of difference between city and rural drivers

Table 4: Difference in drivers versus non-drivers currently attending places and transport type used to get there (from T-ACT-OUT) (n=246)

Anne: Add the note at Bottom –

Note: if the n for driver or non driver was "0", it was deleted for that destination.

T-ACT-OUT place	No-don't currently attend *n*(%)	Yes-currently attend *n*(%)	*P* values[1]	Transport type used to attend T-ACT-OUT place – (transport mode not included when 0 for both groups)	Drivers *n*(%),	Non-drivers *n*(%)
Grocery				Drive	72(35.6)	0
Driver	53(26.2)	149(73.8)		Walk	40(19.8)	14(31.8)
Non driver	17(38.6)	27(61.4)	.142	Passenger	5(2.5)	6(13.6)
				Bus	0	1(.4)
				Missing	32(15.8)	6(13.6)
Supermarket				Drive	137(67)	0
Driver	13(6.4)	189(93.6)		Walk	11(5.4)	10(22.7)
Non driver	11(25.0)	33(75.0)	.001	Passenger	13(6.4)	14(31.8)
				Bus	1(.5)	3(6.8)
				Train	1(.4)	0
				Taxi	0	1(2.3)
				Missing	26(12.9)	5(11.4)
Pharmacy				Drive	109(54.0)	0
Driver	14(6.9)	188(93.1)	.038	Walk	39(19.3)	20(45.5)
Non driver	8(18.2)	36(81.8)		Passenger	7(3.5)	7(15.9)
				Bus	2(1.0)	3(6.8)
				Missing	31(15.3)	6(13.6)
Hairdresser				Drive	108(53.5)	0
Driver	36(17.8)	166(82.2)		Walk	19(9.4)	14(31.8)
Non driver	12(27.3)	32(72.7)	.221	Passenger	2(1.0)	4(9.1)
				Bus	4(2.0)	4(9.1)
				Train	5(2.5)	1(2.3)
				Tram	0	1(2.3)
				Taxi	0	1(2.3)
				Missing	28(13.9)	7(15.9)

Bank/Post-off				Drive	113(55.9)	0
Driver	20(9.9)	182(90.1)		Walk	42(20.8)	20(45.5)
Non driver	10(22.7)	34(77.3)	.036	Passenger	4(2.0)	5(11.4)
				Bus	2(1.0),	3(6.8)
				Train	1(.5)	0
				Tram	0	1(2.3)
				Taxi	0	1(2.3)
				Missing	20(9.9)	4(9.1)
Town Hall				Drive	65(32.2)	0
Driver	107(53.0)	95(47.0)		Walk	9(4.5)	7(15.9)
Non driver	31(70.5)	13(29.5)	.051	Passenger	3(1.5)	1(2.3)
				Bus	0	2(4.5)
				Train	2(1.0)	1(2.3)
				Tram	0	1(2.3)
				Missing	16(7.9)	1(2.3)
Doctor/dentist				Drive	127(62.9)	0
Driver	4(2.0)	198(98.0)		Walk	23(11.4),	18(40.9)
Non driver	3(6.8)	41(93.2)	.212	Passenger	5(2.5),	11(25.0)
				Bus	11(5.4),	4(9.1)
				Train	2(1.0)	0
				Tram	1(.5)	0
				Taxi	1(.5),	2(4.5)
				Missing	28(13.9),	6(13.6)
Hospital				Drive	70(34.7)	0
Driver	86(42.6)	116(57.4)		Walk	4(2.0)	2(4.5)
Non driver	15(34.1)	29(65.9)	.386	Passenger	16(7.9)	10(22.7)
				Bus	7(3.5)	8(18.2)
				Train	5(2.5)	0
				Tram	1(.5),	1 (2.3)
				Taxi	0,	4(9.1)
				Missing	13(6.4)	4(9.1)
Therapy				Drive	32(15.8)	0
Driver	155(76.7)	47(23.3)		Walk	6(3.0)	6(13.6)
Non driver	27(61.4)	17(38.6)	.055	Passenger	1(.5)	3(6.8)

				Bus	1(.5)	4(9.1)
				Train	1(.5)	0
				Taxi	0	2(4.5)
				Missing	6(3.0)	2(4.5)
Day care				Drive	1(.5)	0
Driver	200(99.0)	1(.5)		Bus	0	1(2.3)
Non driver	40(90.9)	1(2.3)	.760	Missing	1(.5)	3(6.8)
Missing	4(7.3)					
Friend/family				Drive	121(59.9)	0
Driver	18(8.9)	184(91.1)		Walk	14(6.9)	5(11.4)
Non driver	10(22.7)	34(77.3)	.019	Passenger	14(6.9),	10(22.7)
				Bus	2(1.0)	9(20.5)
				Train	3(1.5)	1(2.3)
				Tram	0	1(2.3)
				Missing	30(14.9)	8(18.2)
Restaurant				Drive	108(53.5)	0
Driver	11(5.4)	191(94.6)		Walk	26(12.9)	11(25.0)
Non driver	5(11.4)	39(88.6)	.269	Passenger	16(7.9)	4(9.1)
				Bus	3(1.5)	12(27.3)
				Train	2(1.0)	0
				Tram	0	2(4.5)
				Taxi	0	1(2.3)
				Missing	36(17.8)	9(20.5)
Seniors centre				Drive	59(29.2)	0
Driver	93(46.0)	109(54.0)		Walk	10(5.0)	7(15.9)
Non driver	17(38.6)	26(59.1)		Passenger	3(1.5)	6(13.6)
Missing	1 (2.3)		.542	Bus	1(.5)	7(15.9)
				Train	3(1.5)	0
				Missing	33(16.3)	7(15.9)
Worship				Drive	87(43.1)	0
Driver	80(39.6)	122(60.4)		Walk	10(5.0)	12(27.3)
Non driver	16(36.4)	28(63.6)	.819	Passenger	9(4.5)	8(18.2)
				Bus	2(1.0)	2(4.5)

				Train	1(.5)	0
				Missing	13(6.4)	6(13.6)
Entertainment				Drive	90(44.6)	0
Driver	36(17.8)	166(82.2)		Walk	6(3.0)	2(4.5)
Non driver	17(38.6)	27(61.4)	.004	Passenger	21(10.4)	5(11.4)
				Bus	8(4.0)	6(13.6)
				Train	8(4.0)	4(9.1)
				Tram	3(1.5)	1(2.3)
				Taxi	2(1.0)	1(2.3)
				Missing	28(13.9)	8(18.2)
Park				Drive	41(20.3)	0
Driver	72(35.6)	130(64.4)		Walk	55(27.2)	10(22.7)
Non driver	21(47.7)	23(52.3)	.185	Passenger	5(2.5)	5(11.4)
				Bus	1(.5)	3(6.8)
				Missing	28(13.9)	5(11.4)
Seaside/forest				Drive	64(31.7)	0
Driver	71(35.1)	131(64.9)		Walk	19(9.4)	1(2.3)
Non driver	24(54.5)	20(45.5)	.026	Passenger	11(5.4)	8(18.2)
				Bus	5(2.5)	3(6.8)
				Train	3(1.5)	1(2.3)
				Tram	0	1(.4)
				Fly	8(4.0)	2(4.5)
				Missing	21(10.4)	4(9.1)
Cottage				Drive	34(16.8)	0
Driver	144(71.3)	58(28.7)		Passenger	3(1.5)	3(6.8)
Non driver	35(79.5)	9(20.5)	.353	Bus	0	1(2.3)
				Train	2(1.0)	0
				Fly	3(1.5)	2(4.5)
				Missing	16(7.9)	3(6.8)
Neighbourhood				Drive	7(3.5)	0
Driver	40(19.8)	162(80.2)		Walk	124(61.4)	21(47.7)
Non driver	17(38.6)	27(61.4)	.013	Missing	31(15.3)	6(13.6)

Sport facility				Drive	64(31.7)	0
Driver	103(51.0)	99(49.0)		Walk	12(5.9)	4(9.1)
Non driver	31(70.5)	13(29.5)	.029	Passenger	1(.5)	1(2.3)
				Bus	1(.5)	2(4.5)
				Train	1(.5)	0
				Tram	0,	1(2.3)
				Taxi	0	1(2.3)
				Missing	20(9.9)	4(9.1)
Transport Centre				Drive	45(22.3),	0
Driver	59(29.2)	143(70.8)		Walk	11(5.4),	1(2.3)
Non driver	15(34.1)	29(65.9)	.647	Passenger	26(12.9),	10(22.7)
				Bus	14(6.9),	4(9.1)
				Train	4(2.0),	1(2.3)
				Tram	1(.5),	2(4.5)
				Taxi	19(9.4),	5(11.4)
				Missing	23(11.4),	6(13.6)

1.Chi square test used to generate p-values of difference between drivers and non-drivers