Transportation Research Part F 64 (2019) 522–531

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Who's in the driver's seat? Impact on social participation and psychosocial wellbeing in adults aged 50 and over

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ARTICLE INFO

Article history:
Received 28 February 2019
Received in revised form 14 May 2019
Accepted 23 June 2019
Available online 13 July 2019

Keywords:
Transportation
Social participation
Mental health
Loneliness
Aged

ABSTRACT

Social participation is important to maintain physical and mental wellbeing in older age. We examined how transport mode and current driving status affects social participation and psychosocial wellbeing. Data were collected from 8092 community-dwelling adults aged ≥50 years in The Irish Longitudinal Study on Ageing (TILDA), a nationally representative cohort study. Regression analysis was used, examining associations between transport mode and driving status with depressive symptoms, quality of life, loneliness, monthly involvement in active social leisure activities and volunteering and social network strength. 89.8% of adults travel most frequently by car; 72.2% drive themselves. Driving, being driven by a spouse/partner and taking public transport were independently associated with better indicators of social participation and psychosocial wellbeing versus relying on lifts from family/friends. Non-drivers and less frequent drivers had poorer outcomes versus current drivers. These results highlight the importance of being able to travel independently whether by car or public transport. Opportunities to support this should be considered when planning future transport needs of ageing populations.

1. Introduction

Research consistently demonstrates the importance of maintaining social participation and social engagement with increasing age as it leads to improved physical and mental health and decreased mortality (Holt-Lunstad, Smith, & Layton, 2010). Mobility, in the sense of being able to actively move around to participate in society is also important for psychological health and wellbeing in older people. Benefits of mobility include gaining access to desired people or places, involvement in the local community, improvements in physical function due to exercise, psychological benefits of 'getting out and about', and potential for travel even if a trip is not actually undertaken (Metz, 2000).

Mobility can be facilitated through private (walking, cycling, car) and public transport (bus, train) options, however travelling by car is generally the preferred mode of transport for most adults due to its advantages including ease, independence, control, protection, privacy and prestige (Davey, 2007; Ellaway, Macintyre, Hiscock, & Kearns, 2003). Transport patterns change with increasing age due to retirement, increased levels of physical disability and impairment and personal preference. Several studies have shown that older adults, and particularly females, have an increased reliance on walking, being driven by others and using public transport with increasing age (Davis et al., 2011; Li, Raeside, Chen, & McQuaid, 2012; O'Hern & Oxley, 2015; Rosenbloom & Herbel, 2009; Viljanen, Mikkola, Rantakokko, Portegijs, & Rantanen, 2016). Access

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https://doi.org/10.1016/j.trf.2019.06.010
1369-8478/

to a car for older adults has been associated with an increased number of social activities in the past month, better quality of life (Banister & Bowling, 2004) and better mental health (Ellaway, Macdonald, & Kearns, 2016), while cessation of driving in older age has been associated with several adverse outcomes, particularly increased depressive symptoms (Chihuri et al., 2016).

Mokhtarian (2019) describes several review papers which present conceptual models of the association between travel and subjective wellbeing. While some models focus on transport infrastructure (Delbosc, 2012), the economy and the environment (Reardon & Abdallah, 2013), De Vos, Schwanen, Van Acker, and Witlox (2013) identified a number of ways in which an individual's travel behaviour could influence subjective wellbeing, including the experiences occurring during destination-oriented travel, activities conducted while travelling, out-of-home activities that are facilitated by travel, travel as the activity itself and the potential for travel or 'motility'. Motility is an important concept and is influenced by access to available transport options and services, the complex skills and aptitudes required to use them effectively, and the cognitive evaluation of the available options (Flamm & Kaufmann, 2006).

Most existing literature examines different modes of transport, access to a car or driving cessation on social participation and social wellbeing (Banister & Bowling, 2004; Chihuri et al., 2016; Davey, 2007; Musselwhite & Shergold, 2013), however there has been little focus on the person who provides the transport. While car access generally equates to independence and spontaneity, it is important to distinguish between driving and travelling as a passenger. Within couples, men have traditionally defaulted to the role of driver even though many women are capable of driving themselves, thereby travelling together and functioning as a unit. This is an important contrast to situations where older adults need to ask family or friends for lifts; they are sometimes reluctant to do so leading them to neglect discretionary and unplanned trips which are important for social wellbeing in favour of essential trips such as grocery shopping or healthcare visits (Adler & Rottunda, 2006; Davey, 2007; Schwanen, Banister, & Bowling, 2012).

The overall aim of this paper is to examine how transport mode and current driving status affects social participation and psychosocial wellbeing in community-dwelling adults aged ≥50 years in Ireland. It is important to examine and understand this relationship in the context of motility, transport planning for an ageing society and current developments around autonomous cars which would provide greater independence to people of all ages.

First, we report the most frequently used mode of automotive transport taking into account who is the driver. We then examine how differences in transport mode affect social participation and psychosocial wellbeing; how reduced driving and driving cessation affect these outcomes; and if any observed associations are moderated by sex and location. We hypothesise that individuals who drive themselves or are driven by spouses, rather than family or friends, have higher levels of social participation and better psychosocial wellbeing. We then discuss the implications of these findings with reference to the existing literature and we make some suggestions for policymakers. Our analysis includes adults aged ≥50 years, rather than focussing solely on older adults, to reflect the importance of driving status on social participation and psychosocial wellbeing from middle age onwards.

2. Methods

The Irish Longitudinal Study on Ageing (TILDA) is a prospective study of the health, social and economic circumstances of 8172 adults aged ≥50 years, representative of the community-dwelling population in Ireland. Study design and sampling have been outlined previously (Whelan & Savva, 2013). The first wave of data was collected between October 2009 and February 2011. Participants completed a comprehensive Computer Assisted Personal Interview (CAPI) and were given a self-completion questionnaire (SCQ), to which the response rate was 85%. This analysis uses data obtained in the CAPI and SCQ. Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee at Trinity College Dublin. Informed consent was obtained from all participants.

2.1. Driving status

From a list of transport options, participants indicated which mode of transport they used most frequently in the past year. As answer options did not distinguish between being driven by partner/spouse or other family, this was determined using data from partner/spouse interviews. Participants who indicated that they were mainly driven by family but whose partner/spouse indicated that their main mode of transport was driving were categorised within the 'car (driven by partner/spouse)' category. If the partner/spouse (also a participant in the study) did not report driving themselves regularly or if this data was unavailable, participants were categorised as 'car (driven by family/friends/taxi)'. This provided 5 categories: car (driver), car (driven by spouse/partner), car (driven by family/friends/taxi), public transport (bus/train), bicycle. Non-current drivers were asked if they drove in the past while current drivers were asked if they drove less now compared to five years ago; current driving status was then derived (driving at same level, reduced driving, ceased driving, non-drivers).

2.2. Outcome variables

Depressive symptoms over the past week were assessed using the 20-item Centre for Epidemiological Studies Depression (CES-D) scale in the CAPI (range 0–60) (Radloff, 1977). Quality of life and loneliness were measured in the SCQ. Quality of life

reflects the general wellbeing of an individual and was measured using the CASP-19 scale (range 0–57), with higher scores indicating better quality of life (Hyde, Wiggins, Higgs, & Blane, 2003). Loneliness was measured using the 5-item modified version of the University of California-Los Angeles (UCLA) Loneliness scale with scores ranging from 0 (not lonely) to 10 (extremely lonely) (Russell, 1996).

Three specific indicators of social participation were used. Participation in active and social leisure activities (House, Robbins, & Metzner, 1982) at least once per month (versus less than once per month) was collected (attending films, plays and concerts; attending classes and lectures; travelling for pleasure; playing games such as cards and bingo; going to a public house; eating out; and participating in sports or exercise). Volunteering at least once per month was captured as part of the same scale. Social networks strength was measured in the CAPI using the Berkman-Syme Social Network Index. This composite scale (range 0–4) quantified four types of social connection: married; number of close ties with friends, family and children; member of a church; member of voluntary organisations including clubs. A score of 0–1 indicates those most isolated, while 4 indicates those most integrated.

In a sub-analysis, the impact of driving reduction or cessation on (i) how participants socialise with others, like visiting family and friends, (ii) the ability to go about business such as doing the shopping, going to the post office or bank, attending church, etc., (iii) the ability to attend health and social care appointments such as hospital out-patient clinics, over the past 12 months was assessed. Negative impact was defined as affecting these activities 'some, most, or all of the time'.

2.3. Other covariates

Age, sex, education (primary, secondary and tertiary levels corresponding to $\leq$8, 9–13, and >13 years), marital status (married, widowed, divorced/separated, never married) and location (Dublin city/county, other town/city, rural) were obtained. Participants self-reported a doctor diagnosis of heart attack, heart failure, stroke, transient ischaemic attack, chronic lung disease, arthritis, osteoporosis, diabetes, glaucoma, cataracts and age-related macular degeneration; co-morbidity was categorised as 0, 1, 2, $\geq$3 conditions. The number of regular medications was obtained. These covariates were chosen as they would be expected to be, or have previously been associated with driving and psychosocial wellbeing and social participation. Rate of missingness for these variables was <2%.

2.4. Statistical analysis

Statistical analyses were conducted using Stata v14 (StataCorp LP, Texas, USA). Baseline characteristics of the total sample and the sample stratified by transport mode were summarised. Indicators of social participation and psychosocial wellbeing are presented for participants with available data.

Linear regression models were used to examine the associations between transport mode and continuous outcomes reflecting psychological wellbeing (i.e. depressive symptoms, quality of life, loneliness) and social network score. Logistic regression models were used to examine associations between transport mode and social participation and volunteering, which have categorical outcomes. Car (driven by family/friends/taxi) was the reference condition. In all analyses, Model 1 was unadjusted while Model 2 was adjusted for age, sex, education, marital status, location, co-morbidity and number of medications. Finally, we added interaction terms for driving * location and separately for driving * sex to the regression models. We used the Stata cluster command in all models to account for the non-independence of measurements between individuals in the same household. Marginal effects were plotted to illustrate interactions following adjustment for covariates. Analyses were repeated to examine associations between current driving status on psychosocial wellbeing and social participation.

All models included inverse probability weights (at participant level), created by comparing age, sex, education, marital status and geography of participants to their distribution in the Irish Census 2011. Weights were modified further, to reflect the non-uniform probability that participants returned the SCQ.

3. Results

Of the 8172 participants in the sample, 8092 indicated their most frequent mode of transport and were included in the analysis. Table 1 shows descriptive statistics; mean age was 63.8 years (range 50–105 years), 54.1% were female and 48% lived in rural areas. The car was the most frequently used mode of transport (87.8%) followed by public transport (8.5%) and motorbike/bicycle (1.7%), however this varied by location with 23.3% using public transport in Dublin versus 1.9% in rural areas. Most participants drove themselves (72.2%) with 11.7% and 5.9% relying on lifts from family/friends/taxi and spouse/partner respectively. Drivers were younger, more likely to be male, married, living in rural areas and in better physical health compared to passengers. Due to small numbers who travelled by motorbike/bicycle (n = 135), this group was excluded from further analysis.

In unadjusted regression analysis, driving oneself, being driven by a spouse/partner or taking public transport was associated with better indicators of psychosocial health and higher levels of social participation compared to relying on lifts from family/friends/taxi (Table 2); the majority of effects were attenuated but significant after adjustment for covariates (Model 2). Driving oneself had the largest effect sizes for all outcomes reflecting better mental health and higher social participation; using public transport was also associated with more social active leisure activities, volunteering and social networks than

Table 1
Descriptive statistics of the total sample and sample stratified by transport mode.

	Car (driver) (n = 5844) Mean ± SD/n (%)	Car (driven by partner/spouse) (n = 477) Mean ± SD/n (%)	Car (driven by family/friends/taxi) (n = 949) Mean ± SD/n (%)	Public transport (n = 687) Mean ± SD/n (%)	Other (n = 135) Mean ± SD/n (%)	Total (n = 8092) Mean (SD)/n (%)
Age (years)	62.3 ± 8.9	65.6 ± 9.1	71.3 ± 11.3	65.0 ± 10.1	62.3 ± 9.1	63.8 ± 9.8
Sex (female)	2771 (47.4)	387 (81.1)	726 (76.5)	455 (66.2)	40 (29.6)	4379 (54.1)
Education						
Primary	1340 (22.9)	194 (40.7)	569 (60.0)	304 (44.4)	53 (39.3)	2460 (30.4)
Secondary	2465 (42.2)	201 (42.1)	301 (31.8)	228 (33.3)	41 (30.4)	3236 (40.0)
Tertiary	2038 (34.9)	82 (17.2)	78 (8.2)	153 (22.3)	41 (30.4)	2392 (29.6)
Marital status						
Married	4342 (74.3)	477 (100)	361 (38.0)	342 (49.8)	83 (61.5)	5605 (69.3)
Never married	494 (8.4)	0 (0)	127 (13.4)	120 (17.5)	31 (23.0)	772 (9.5)
Divorced/Separated	385 (6.6)	0 (0)	61 (6.4)	84 (12.2)	13 (9.6)	543 (6.7)
Widowed	623 (10.7)	0 (0)	400 (42.2)	141 (20.5)	8 (5.9)	1172 (14.5)
Location						
Dublin city/county	1221 (20.9)	83 (17.4)	126 (13.3)	447 (65.1)	42 (31.1)	1919 (23.7)
Other town/city	1539 (26.4)	162 (34.0)	360 (38.1)	168 (24.4)	54 (40.0)	2283 (28.3)
Rural	3075 (52.7)	232 (48.6)	460 (48.6)	72 (10.5)	39 (28.9)	3878 (48.0)
Co-morbidity						
0 conditions	3168 (54.3)	187 (39.3)	289 (30.6)	317 (46.4)	84 (62.7)	4045 (50.1)
1 condition	1767 (30.3)	154 (32.4)	317 (33.5)	195 (28.5)	34 (25.4)	2467 (30.5)
2 conditions	621 (10.6)	83 (17.4)	186 (19.7)	107 (15.7)	12 (9.0)	1009 (12.5)
$\geq$3 conditions	281 (4.8)	52 (10.9)	153 (16.2)	64 (9.4)	4 (3.0)	554 (6.9)
Number of medications	1.2 ± 1.1	1.7 ± 1.1	1.9 ± 1.1	1.5 ± 1.1	0.9 ± 1.0	1.3 ± 1.1
Depressive symptoms (CES-D)	5.2 ± 6.5	6.4 ± 7.9	8.0 ± 8.4	8.3 ± 9.0	5.9 ± 6.9	5.8 ± 7.2
Quality of life (CASP-19)	44.9 ± 7.3	43.9 ± 7.7	40.8 ± 8.9	43.1 ± 8.1	45.0 ± 7.3	44.3 ± 7.7
Loneliness (UCLA)	1.8 ± 2.1	1.8 ± 2.1	2.6 ± 2.4	2.5 ± 2.5	2.1 ± 2.3	1.9 ± 2.2
Active social leisure monthly	4658 (91.7)	349 (83.5)	507 (73.7)	491 (88.0)	102 (91.9)	6107 (89.1)
Volunteer monthly	1545 (31.5)	84 (21.3)	89 (14.0)	134 (26.2)	32 (29.9)	1884 (28.7)
Social networks score	2.9 ± 0.9	3.1 ± 0.7	2.3 ± 0.8	2.5 ± 0.9	2.5 ± 1.0	2.8 ± 0.9

Notes: Mean ± SD for continuous variables; n (%) for categorical variables.

Table 2
Results of the regression models examining the association between mode of transport, psychosocial wellbeing and social participation.

	Depressive symptoms (CES-D) β (95% CI)		Quality of life (CASP-19) β (95% CI)	
Car (family/friends/taxi)	Model 1 Ref	Model 2 Ref	Model 1 Ref	Model 2 Ref
Car (self)	−2.63 (−3.23, −2.04)***	−1.95 (−2.59, −1.30)***	4.33 (3.41, 5.26)***	4.11 (3.13, 5.08)***
Car (partner/spouse)	−1.54 (−2.47, −0.60)**	−0.98 (−1.93, −0.03)*	3.47 (2.21, 4.73)***	3.02 (1.75, 4.28)***
Public transport	0.49 (−0.43, 1.41)	0.10 (−0.85, 1.05)	2.55 (1.33, 3.76)***	2.42 (1.17, 3.67)***
n	7834	7733	5752	5696
	Loneliness (UCLA) β (95% CI)		Social network score β (95% CI)	
Car (family/friends/taxi)	Model 1 Ref	Model 2 Ref	Model 1 Ref	Model 2 Ref
Car (self)	−0.84 (−1.07, −0.61)***	−0.45 (−0.70, −0.21)***	0.62 (0.56, 0.69)***	0.38 (0.32, 0.44)***
Car (partner/spouse)	−0.94 (−1.24, −0.63)***	−0.15 (−0.45, 0.16)	0.82 (0.72, 0.91)***	0.19 (0.10, 0.29)***
Public transport	−0.14 (−0.47, 0.18)	−0.10 (−0.23, 0.43)	0.21 (0.11, 0.30)***	0.28 (0.20, 0.37)***
n	6523	6458	7931	7826
	Social active leisure monthly OR (95% CI)		Volunteering monthly OR (95% CI)	
Car (family/friends/taxi)	Model 1 Ref	Model 2 Ref	Model 1 Ref	Model 2 Ref
Car (self)	3.78 (3.05, 4.68)***	2.22 (1.73, 2.85)***	2.87 (2.23, 3.69)***	2.83 (2.12, 3.78)***
Car (partner/spouse)	1.74 (1.25, 2.42)**	1.43 (1.00, 2.05)	1.83 (1.29, 2.59)**	1.84 (1.26, 2.68)**
Public transport	2.55 (1.83, 3.56)***	1.67 (1.16, 2.41)*	2.24 (1.63, 3.10)***	2.54 (1.79, 3.61)***
n	6741	6671	6445	6377

Model 1: unadjusted.
Model 2: adjusted for age, sex, education, location, marital status, co-morbidity, number of medications.
Use of car as the most frequently used mode of transport is sub-divided based on who the driver is.
Analysis of some variables (quality of life, loneliness, social active leisure and volunteering) are based on a smaller sample as they were obtained during the SCQ; the other variables (depressive symptom, social network score) were obtained during the CAPI.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

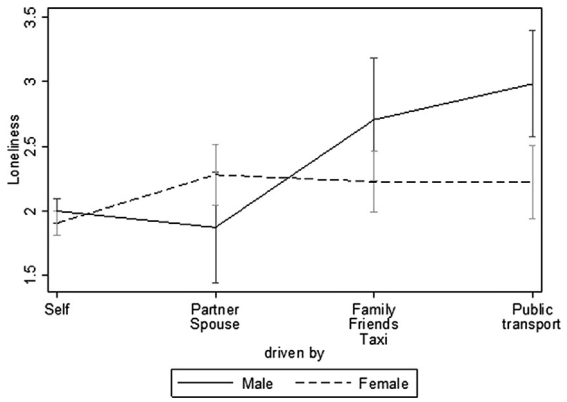

Fig. 1. Moderation effects of transport mode with sex on loneliness (UCLA Loneliness scale). Adjusted for age, sex, education, location, marital status, co-morbidity, number of medications.

for those being driven by spouse/partner. Moderation analysis showed that men who regularly travelled by public transport had higher loneliness scores than women travelling by public transport (β = 0.67, 95% CI: 0.16, 1.18, $p < 0.05$) (Fig. 1).

Adults who reduced their driving levels over the past five years reported higher depressive symptoms and loneliness and lower quality of life compared to those who maintained driving levels, independent of socio-demographics and physical health (Table 3). These effects were amplified in non-drivers and those who ceased driving; these groups were also less likely to take part in social leisure activities and volunteering and had fewer social networks compared to drivers. Moderation analysis showed that men who ceased driving reported higher levels of loneliness than women (β = 0.56, 95% CI: 0.02, 1.11, $p < 0.05$) while the higher levels of depressive symptoms associated with reduced driving (β = 0.96, 95% CI: 0.20, 1.73, $p < 0.05$) were mainly due to the lower levels in male drivers (Fig. 2). In addition, adults in other urban and rural areas

Table 3
Results of the regression models examining the association between current driving status, psychosocial wellbeing and social participation.

	Depressive symptoms (CES-D) β (95% CI)		Quality of life (CASP-19) β (95% CI)	
Driving (same level)	Model 1 Ref	Model 2 Ref	Model 1 Ref	Model 2 Ref
Reduced driving	1.22 (0.81, 1.63)***	1.15 (0.74, 1.56)***	−1.66 (−2.18, −1.14)***	−1.37 (−1.89, −0.86)***
Ceased driving	3.20 (2.37, 4.03)***	2.74 (1.92, 3.55)***	−3.56 (−4.66, −2.46)***	−3.27 (−4.37, −2.16)***
Non-drivers	3.28 (2.74, 3.82)***	2.52 (1.93, 3.11)***	−3.92 (−4.69, −3.16)***	−3.68 (−4.50, −2.86)***
n	7905	7804	5792	5735
	Loneliness (UCLA) β (95% CI)		Social network strength β (95% CI)	
Driving (same level)	Model 1 Ref	Model 2 Ref	Model 1 Ref	Model 2 Ref
Reduced driving	0.29 (0.15, 0.43)***	0.28 (0.14, 0.42)***	−0.04 (−0.10, −0.01)	−0.04 (−0.08, 0.01)
Ceased driving	0.88 (0.59, 1.17)***	0.71 (0.43, 0.98)***	−0.48 (−0.57, −0.38)***	−0.28 (−0.36, −0.21)***
Non-drivers	0.76 (0.57, 0.95)***	0.55 (0.34, 0.75)***	−0.49 (−0.55, −0.43)***	−0.29 (−0.34, −0.23)***
n	6577	6511	8008	7902
	Social active leisure monthly OR (95% CI)		Volunteering monthly OR (95% CI)	
Driving (same level)	Model 1 Ref	Model 2 Reef	Model 1 Ref	Model 2 Ref
Reduced driving	0.76 (0.62, 0.92)**	0.82 (0.66, 1.01)	1.07 (0.94, 1.20)	1.11 (0.96, 1.28)
Ceased driving	0.46 (0.34, 0.61)***	0.70 (0.50, 0.97)*	0.67 (0.53, 0.86)**	0.66 (0.50, 0.88)**
Non-drivers	0.25 (0.21, 0.31)***	0.40 (0.11, 0.50)***	0.47 (0.39, 0.57)***	0.59 (0.47, 0.73)***
n	6798	6727	6497	6428

Reference category is currently driving same amount compared to 5 years ago.
Model 1: unadjusted.
Model 2: adjusted for age, sex, education, location, marital status, co-morbidity, number of medications.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

reported higher loneliness compared to those in Dublin (β = 0.58, 95% CI: 0.22, 0.95, $p < 0.05$ and β = 0.49, 95% CI: 0.18, 0.81, $p < 0.05$ respectively), while the effects of ceasing driving were similar regardless of location (Supplementary Fig. 1).

In a sub-analysis, we examined the negative impact on socialising, completing daily errands and healthcare-related activities in adults who reported that they no longer drive (n = 599) or had reduced driving frequency in the past five years (n = 2080). Those who ceased driving reported a greater negative impact on socialising (OR 3.46, 95% CI: 2.62, 4.57, $p < 0.001$), daily errands (OR 5.98, 95% CI: 4.31, 8.30, $p < 0.001$) and healthcare-related activities (OR 4.66, 95% CI: 3.12, 6.95, $p < 0.001$) compared to those who reduced driving frequency, after accounting for socio-demographics and physical health.

4. Discussion

Social participation is a vital component of healthy ageing and is associated with higher levels of physical health and social wellbeing and reduced mortality (Berkman & Syme, 1979; Holt-Lunstad et al., 2010; House et al., 1982). Access to appropriate transport infrastructure should facilitate these activities, promote social engagement and therefore, enhance social wellbeing. This study highlights that the majority of community-dwelling adults aged ≥50 years rely on the car with low numbers travelling mainly by public transport, especially in rural areas. Driving was associated with better psychosocial health and higher levels of social participation compared to being driven by family/friends/taxi. Being driven by a partner/spouse or taking public transport were also associated with better outcomes. Driving less frequently was associated with poorer outcomes and these effects were more pronounced for non-drivers and those who have stopped driving.

These findings highlight a number of important points. Firstly, the ability to drive is beneficial for social engagement and mental health, consistent with previous research (Banister & Bowling, 2004; Ellaway et al., 2016). Driving allows a level of freedom and independence that is often not available with public transport; having a valid driver's licence is also associated with larger life-space mobility, reflecting spatial movement in the environment (Shah et al., 2012). According to a recent review on unmet travel needs, adults without access to a car were more likely to report unfulfilled needs, with leisure trips, such as visiting family or others most often affected (Luiu, Tight, & Burrow, 2017). Generally, drivers were in better physical health than non-drivers which may partly explain these associations, however driving was also an important predictor of social participation in those with multi-morbidity, highlighting how a car can help compensate for poorer health and

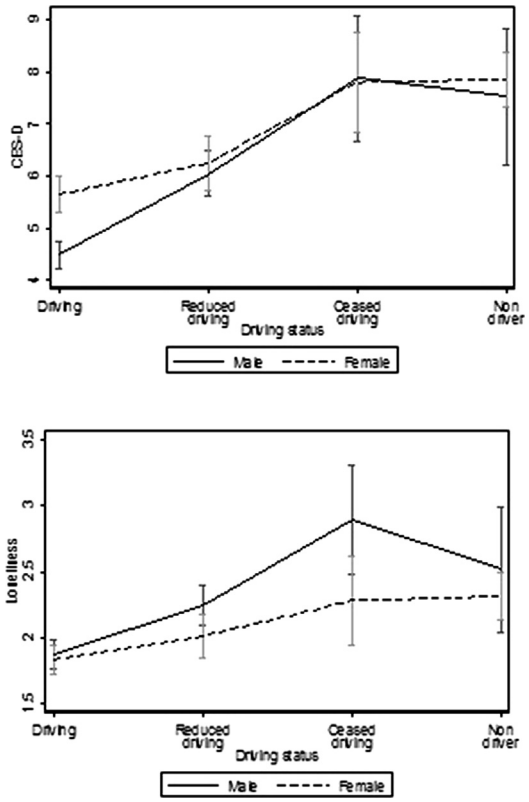

Fig. 2. Moderation effects of current driving status with sex on (a) depressive symptoms (CES-D score) and (b) loneliness (UCLA Loneliness scale). Adjusted for age, sex, education, location, marital status, co-morbidity, number of medications. Only those models with significant effects are presented here.

function (Galenkamp et al., 2016). In Ireland, adults must submit a medical report from their GP in order to renew their driving licence at age 70, however requirements vary across different countries. The European Commission recently recommended a uniform approach where 'fitness to drive' is based on relevant health and functional abilities required to drive safely rather than age or diagnosis of specific diseases (Polders, Brijs, Vlahogianni, Papadimitriou, Yannis, Leopold, & Diamandouros, 2015).

Secondly, many older adults rely on lifts from family and friends to complete essential daily activities and to maintain social networks, which is consistent with previous research (Kostyniuk & Shope, 2003). However, they are often reluctant to ask others for lifts as they do not want to be a burden and want to be able to reciprocate; therefore they prioritise 'essential' trips over discretionary and social trips (Adler & Rottunda, 2006; Davey, 2007; Schwanen et al., 2012). It is likely that this unwanted feeling of dependence was reflected by better outcomes associated with self-directed travel and reliance on a spouse/partner rather than family/friends/taxi. Importantly, this finding does not necessarily indicate that lifts from family and/or friends are not available. Musselwhite and Shergold (2013) reported that many older people were satisfied that the provision of lifts not only allowed them to access services even though the frequency of travel was less, but also that they experienced increased social interaction with family and friends as a result. In contrast to these studies, one paper reported that while experts considered reliance on others as an important barrier to outdoor mobility, older Europeans themselves did not (Risser, Haindl, & Ståhl, 2010). Regardless, access to lifts from family/friends plays a hugely important role in providing transport for older adults and a greater appreciation of any potential conflict between need and perceived burden may help older adults and their family/friends to identify solutions that ease this concern e.g. having an acceptable and pre-arranged form of reciprocation.

Thirdly, reducing or stopping driving, especially if not by choice, is a big upheaval in many older people's lives and the negative impact on social engagement and mental health has been reported (Chihuri et al., 2016; Davey, 2007). However, changing transport patterns may affect men moreso than women. In this sample, 10.4% of women reported travelling most frequently on public transport compared to 6.2% of men, and these women reported lower loneliness scores than men. This may reflect different gender attitudes towards transport. Men place a greater personal value on driving, are less likely to travel as a passenger than a driver (Schmöcker, Quddus, Noland, & Bell, 2008) and report higher depressive symptoms after stopping driving than women (Windsor, Anstey, Butterworth, Luszcz, & Andrews, 2007). In this analysis, the change in depressive symptoms from driving to non-driving (but not the actual level) was larger in men than women and men also

reported higher loneliness scores after stopping driving. Conversely, women value driving more for its practical benefits (Siren & Hakamies-Blomqvist, 2005); however, they are also more likely to live alone as they get older, less likely to drive, and therefore more likely to rely on family and friends for lifts or public transport. This places them at greater risk of poorer psychosocial wellbeing and reduced social participation, although this may change in future cohorts as higher proportions of women drive and continue to drive for longer.

Musselwhite and Haddad (2010) reported that most older adults are aware of limitations in their driving-related abilities, but feel that they can compensate for these by changing their driving and/or travel behaviours. However, in most cases, changes in function, confidence and perceptions of safety are factors that will often influence the decision to reduce or stop driving (Musselwhite & Shergold, 2013). Therefore, regardless of gender, early planning, flexibility with destinations and the availability of suitable alternatives are important to facilitate this transition from driving to driving cessation (Musselwhite & Haddad, 2010). Ideally, ageing individuals could continue their desired level of social activity without needing to rely on others to drive them. Public transport services play an important role but face challenges to maintain routes and minimise costs especially given the high reliance nationally and internationally on the car. Consequently, public transport services are declining especially in rural areas which will negatively impact the social health and wellbeing of older adults who rely on these services. Urban planners should consider innovative ways to promote public transport and maintain services that meet the needs of older adults including linked transport services, user involvement in determining public transport schedules, priority seating, car donation and car share schemes as well as maintaining the availability of everyday amenities and services within the community.

Innovative developments around autonomous cars may also help maintain mobility and social engagement for those unable to drive themselves, particularly those living in rural areas with poor public transport links. Advanced vehicle technologies or driver assistance systems can help the older population, and particularly those with reduced mobility, to stay mobile, while maintaining road safety by compensating for age-related functional declines (Polders, Brijs, Vlahogianni, Papadimitriou, & Yannis, 2015). Interestingly, when couples travelled in real traffic together, the passengers provided continuous feedback, particularly looking out for oncoming traffic at intersections (Mårdh, 2016). Studies like this can provide valuable information about the strategies used by older adults, which can then be combined with knowledge about the age-related functional declines to inform the development of assistive technologies. Developments in these vehicles can range from semi-automation to full automation, however it may be several decades before they become affordable to a middle-income family. Advanced driver assistance and information systems that compensate for the age-related functional limitations have the potential to enable older drivers to remain driving safely for longer, by assisting with the complex tasks of driving (Eby et al., 2016; Young, Koppel, & Charlton, 2017). Options include collision-warning systems, vision enhancement systems, navigation systems and Mayday systems (Commission, 2015). These are designed to compensate for driving-related difficulties that older adults experience in relation to vision and hearing, cognitive processing and decision-making, interactions with other road users, and physical changes and thus they contribute to a reduction in risk of motor vehicle collisions (Davidse, 2006). For older car drivers, these automation systems provide services or perform tasks that should make driving easier, less stressful, and safer (Mitchell & Suen, 1998) and allow them to travel to places and at times that they would normally avoid (Eby et al., 2016). However Young et al. (2017) stress that driver assistance systems or in-vehicle information systems will only be effective if they are designed to fit with the age-related functional limitations of older drivers.

It is also likely that the development of non-transport related assistive technologies such as telehealth solutions which provide remote monitoring of health and sharing of data with healthcare professionals, technologies to promote remote/virtual social interactions and technologies enabling remote access to goods and services will have knock-on effects on travel needs and patterns of older adults, particularly in relation to non-leisure travel (Shergold, Lyons, & Hubers, 2015). However, given the preferences and benefits of in-person interactions, it is important that these developments assist independent living but do not replace opportunities for face-to face contact (Philip, Roberts, Currie, & Mort, 2015).

Another consideration is the environmental impact of continued driving among an increasing sector of the population. Schwanen, Dijst, and Dieleman (2001) have shown that while older adults spend a considerable amount of time at home, they also travel frequently by car especially if they own a car. They suggest that future cohorts of seniors will make more leisure trips than the current cohort, however the environmental impact of this may be compensated to some degree by the introduction of electric cars and legislation around fuel efficiency, CO_2 emissions and fuel quality.

Strengths of this study include the nationally representative sample of community-dwelling adults aged $\geq$50 years who provided comprehensive information about social participation and psychosocial wellbeing. The main limitation was that participants were asked if the main mode of transport was in a car driven by family rather than specifically a partner/spouse or other family member. However, being driven by a partner/spouse was identified if a participant was driven by family, the partner/spouse also took part in the study and indicated that they drove regularly and there was a car in the household. Only 6% of participants whose partner/spouse did not take part in the study reported having a household car, so assigning these participants as 'driven by family/friends/taxi' was appropriate. As walking was not included in the list of options, the transport modes presented may be overestimated. Finally, the questions on driving were included in the baseline TILDA interview only and not in any follow-up waves, therefore this analysis is limited to cross-sectional data collected from 2009 to 2011 so causality cannot be implied.

5. Conclusions

In conclusion, driving, being driven by a spouse/partner and taking public transport were associated with higher social participation and better psychosocial health compared to relying on lifts from family or friends. To the authors' knowledge, this is the first study to examine how social and mental health outcomes vary depending on who is driving. The findings likely reflect a desire for independence and/or reluctance to be reliant on others, which is an important consideration when planning for the future transport needs of an ageing population as there is less flexibility in the choice of driver as people get older. Urban planning should consider the needs of an ageing population in relation to the placement and availability of local amenities and services, public transport links in rural areas, and alternative modes of transport for older people to access and maintain their desired level of social interactions. Furthermore, these findings highlight how the onset of autonomous cars may enhance the lives of older people, and enable older people to remain socially active.

Acknowledgements

The authors would like to thank the participants and the TILDA team.

Funding

The Irish Longitudinal Study on Ageing (TILDA) was funded by the Department for Health and Children; the Atlantic Philanthropies; and Irish Life plc. These funders had no role in the preparation of this manuscript.

Contributorship statement

OD: Substantial contributions to the acquisition, analysis or interpretation of data; drafting the work or revising it critically for important intellectual content; final approval of the version published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CMcG: Substantial contributions to the acquisition, analysis or interpretation of data; revising the work critically for important intellectual content; final approval of the version published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

RAK: Substantial contributions to the conception or design of the work, or the acquisition, analysis or interpretation of data; revising the work critically for important intellectual content; final approval of the version published; agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.trf.2019.06.010.

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