

Travel difficulties and barriers during later life

Luiu, Carlo; Tight, Miles

DOI:

[10.1016/j.jtrangeo.2021.102973](https://doi.org/10.1016/j.jtrangeo.2021.102973)

License:

Creative Commons: Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)

Document Version

Peer reviewed version

Citation for published version (Harvard):

Luiu, C & Tight, M 2021, 'Travel difficulties and barriers during later life: evidence from the National Travel Survey in England', *Journal of Transport Geography*, vol. 91, 102973.
<https://doi.org/10.1016/j.jtrangeo.2021.102973>

[Link to publication on Research at Birmingham portal](#)

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

1
2 **Travel difficulties and barriers during later life: Evidence from the**
3 **National Travel Survey in England**
4

5 **Abstract**

6 Using data from the National Travel Survey in England, this study investigates which factors
7 lead to experiencing travel difficulties among people aged 60 years old and above. The ability
8 to be mobile is one of the key factors enabling older people to maintain their wellbeing and
9 independence while ageing. Given the shift towards an ageing population that our society is
10 experiencing, providing an age-friendly transportation environment becomes necessary to
11 allow older people to be able to fulfil their travel needs and keep involved in societal
12 participation. By employing a conceptual framework based on five interrelated domains
13 shaping mobility during later life, this paper explores older people's difficulties in accessing
14 transport resources, mode usage and undertaking out-of-home activities. Poor health and
15 wellbeing conditions, lack of access to transport resources and gender are identified as the main
16 predictors to experiencing travel difficulties in later life, while activities more affected in this
17 sense are medical appointments, visiting family or friends and social ones. The findings have
18 implications for policies, planning and interventions targeting age-friendly and inclusive
19 transport and environment and show the need to move beyond the transport domain and employ
20 a more holistic and intersectionality-based approach to understand what affects and shapes
21 mobility in later life.

22
23 **Keywords:** older people; travel difficulties; transport barriers; social exclusion; unmet travel
24 needs; ageing.

25

26

27 **1 Introduction**

28 The World Health Organization (2015) asserts that the ability to be mobile is fundamental for
29 a healthy ageing, as this is a necessary condition to access goods, services and facilities and to
30 take part in social and cultural activities. Indeed, it is well acknowledged that being mobile is
31 one of the key factors associated with wellbeing and independence during later life (Farquhar,
32 1995; Gabriel and Bowling, 2004; Nordbakke and Schwanen, 2014). Therefore, providing age-
33 friendly access to transportation is becoming increasingly important due to the demographic
34 shift towards an ageing population that both developing and developed countries are
35 experiencing.

36 Several studies indicate that out-of-home mobility trends tend to reduce with age (Haustein et
37 al., 2013). Reduction in mobility has been associated with the deterioration of health conditions
38 (Haustein et al., 2013; Hjorthol, 2013; Siren and Hakamies-Blomqvist, 2004), but also
39 inadequate travel resources and environment for mobility contribute in this regard (Schwanen
40 and Páez, 2010; World Health Organization, 2015). A potential implication of reduced mobility
41 is the risk of experiencing transport difficulties and disadvantages and, consequently, transport-
42 related social exclusion. Issues related to social exclusion are particularly relevant for the older
43 population, as this group is considered amongst those most at risk of experiencing transport
44 difficulties and disadvantages (Evans, 2001; Schwanen and Páez, 2010). Social exclusion is a
45 topic that has received substantial attention in the last two decades within the transport field,
46 due to the connection between poor transport, difficulties in societal participation and
47 individuals wellbeing (Delbosc and Currie, 2011; Hine and Mitchell, 2003; Lucas, 2012, 2004;
48 Preston and Rajé, 2007). Social exclusion has been often associated with the concept of
49 poverty, as people with poor financial resources are more likely to experience transport
50 disadvantage and difficulties to access services and goods, especially in case of poor access to
51 private transport and/or if living in deprived areas (Hine and Mitchell, 2003; Lucas, 2004).

52 Nonetheless, it has been acknowledged that poverty is not only a matter of poor financial
53 resources but rather the result of a combination of different factors (Delbosc and Currie, 2011)
54 in which age is recognised as a potential predictor (Lucas, 2019; Páez et al., 2009). Lucas
55 (2012) highlights that transport poverty is more the consequence of the direct and/or indirect
56 interactions between transport and social disadvantages leading to inaccessibility to goods,
57 services planning and the decision-making process. In this regard, Church et al. (2000) identify
58 seven main categories associated with mobility that can be affected in terms of social exclusion:

- 59 i. *Physical exclusion* - the physical nature of the transport system that create barriers
60 to access by impaired people;
- 61 ii. *Geographical isolation* - the dispersion of locations that reduce the ability to
62 undertake activities in specific areas;
- 63 iii. *Exclusion from facilities* - the distance of services and facilities from dwellings;
- 64 iv. *Economic exclusion* - the issues related to travel cost that limit the extension of work
65 travel patterns and job search;
- 66 v. *Time-based exclusion* - the constraint of organising commitments to allow time for
67 travelling;
- 68 vi. *Fear-based exclusion* - the problems related to personal security when travelling in
69 public spaces;
- 70 vii. *Space exclusion* - the management of security or space preventing access to public
71 and quasi-public transport spaces.

72 Although older people tend to reduce their mobility patterns while ageing, this does not
73 automatically translate into a decrease in travel needs. On the contrary, older people might
74 require more needs for social and health services and also have more available time to carry

75 out their out-of-home activities (Kim and Ulfarsson, 2004). Moreover, the newer cohorts of
76 older people are shown to be wealthier and healthier and with higher mobility expectations
77 compared to those in the past (Coughlin, 2009; Siren and Haustein, 2015). In their review of
78 the literature looking at factors affecting travel needs fulfilment in later life, Luiu et al. (2017)
79 report that at least one-third of older people experience unmet travel needs. Leisure and social,
80 especially visiting family or other people, were the out-of-home activities were most affected,
81 particularly by women and people aged above 75 years old.

82 Research on travel needs in later life has been focusing particularly on the impacts of access to
83 transport resources, particularly private vehicles. Access to the car in the household and holding
84 a driving licence are considered crucial factors for needs fulfilment and older people's
85 independence (Haustein and Siren, 2014; Kim et al., 2014; Musselwhite and Haddad, 2010;
86 Siren and Haustein, 2014). This importance is also stressed by studies looking at alternative
87 options to travel after driving cessation, where the car remains the preferred way of travelling
88 through lifts from family members or friends (Davey, 2007; Glasgow and Blakely, 2000;
89 Shergold et al., 2012). The role of accessing a car for older people is also highlighted by the
90 significant travel barriers faced while using alternative modes (see the review from Luiu et al.,
91 2018c). Public transport is often perceived as unresponsive to meet older people's travel needs
92 (Risser et al., 2010) due to issues related to service provision and availability, long waiting
93 times, and walking distances to reach closest stops (Broome et al., 2010b, 2013; Buys et al.,
94 2012; Fiedler, 2007; Mattson, 2010; Su and Bell, 2009). Safety and concerns over personal
95 security also affect public transport use. Travelling alone (especially while dark), overcrowded
96 buses, the behaviour of other passengers (Broome et al., 2010a; Gilhooly et al., 2002;
97 Ipingbemi, 2010; Odufuwa, 2006; Risser et al., 2010) and recently COVID-19 implications
98 (Ravensbergen and Newbold, 2020) are the most reported barriers in this sense.

99 Individual and built environment factors also influence travel needs fulfilment. Suffering from
100 poor health conditions and subjective wellbeing is linked with reduced ability to carry out a
101 smaller range of activities (Scheiner, 2006) and difficulties in using transport modes,
102 particularly walking. Public transport is also affected due to boarding, alighting and standing
103 operations and where stops are far from home or destinations (Hjorthol, 2013; Wretstrand et
104 al., 2009). Cognitive, physical and sensory impairments also limit car use (Adler and Rottunda,
105 2006; Seiler et al., 2012), and health issues are considered as the main predictor for driving
106 cessation (Haustein et al., 2013; Haustein and Siren, 2014; Hjorthol, 2013).

107 Household characteristics have been identified as factors linked with needs fulfilment. Older
108 people who live alone have been shown to travel less (Tacken, 1998), report more desire to
109 undertake leisure and social activities because of the need for satisfying these needs outside the
110 home (Nordbakke and Schwanen, 2015) and have reduced access to car lifts in the case of
111 driving cessation (Musselwhite and Haddad, 2010). At the same time, older people living with
112 a partner and/or extended family members might face unfulfilled needs due to caregiving duties
113 of spouse and children (Kim et al., 2014; Knight et al., 2007; Mollenkopf et al., 2011; Scheiner,
114 2006). Built environment characteristics affect the way older people travel (Loukaitou-Sideris
115 et al., 2019) and access activity, both spatially and temporally (Evans, 2001). Nonetheless, the
116 spatial context seems to not affect travel needs fulfilment (Haustein and Siren, 2014; Hjorthol,
117 2013; Nordbakke and Schwanen, 2015; Scheiner, 2006).

118 An interesting finding from Luiu et al. (2017) was that, because of the variety of research
119 approaches used and the heterogeneity characterising older people, their review was not
120 conclusive in identifying the real impact of the measures employed to investigate unfulfilled
121 needs. Therefore, this paper aims at filling this gap by identifying which are the main factors
122 leading to experiencing travel difficulties during later life. By examining data from the National

123 Travel Survey (NTS) in England, this research expands the investigation of unfulfilled mobility
124 and transport barriers faced by older adults within the UK context. Particularly, this study
125 builds on the conceptual framework developed by Luiu et al. (2018b), with the purpose of
126 taking into account a broader range of factors influencing the mobility of the older population
127 compared to previous studies. Additionally, this study explores how the NTS is investigating
128 the issue of travel difficulties and what potential gaps need to be addressed.

129

130 **2 Data and methods**

131 *2.1 Sample*

132 The study investigates a survey sample of people aged 60 years old and above from the NTS
133 2016, which resulted in 4025 participants after eliminating cases with missing information
134 (Table 1). The NTS is a cross-sectional government survey carried out in England (and in
135 Wales until 2013) by the Department for Transport to monitor individuals travel behaviour and
136 changes in travel patterns, assessing the potential equality impacts of transport policies,
137 contributing to the evaluation of the impact of policies and providing inputs for transport
138 modelling and appraisal guidance. The NTS data are gathered from face-to-face interviews and
139 a self-completed travel diary recording journeys for seven days. with a sample of around 17,000
140 households. Data collected in the survey involve journey origin and destination, travel purpose,
141 mode, distance and time travelled, number travelling in their party, vehicles used, tickets used
142 and cost (NatCen, 2017).

143 It is important to note that the NTS consider not eligible to take part in the survey people
144 dwelling in communal establishments/institutions, defined as “address at which four or more
145 unrelated people sleep” (NatCen, 2017). Consequently, older people residing in dwellings such
146 as care and nursing homes, retirement villages and sheltered housing are systematically
147 excluded by the survey. Moreover, this study uses the data from the NTS 2016, despite the

148 NTS 2017 is the latest available from UK Data Service. Using data from the 2016 survey is
 149 due to the availability of a set of questions related to difficulties to carry out activities, which
 150 are rotated questions (*i.e.* in the survey every two years) asked only during even years (NatCen,
 151 2017).

152 **Table 1.** Socio-demographic characteristics of the survey participants (n=4025)

Characteristics	%		%
<i>Gender</i>		<i>Income</i>	
Male	46.7	Less than £25,000	53.2
Female	53.3	£25,000 to £49,999	28.2
		£50,000 and over	18.6
<i>Age groups</i>		<i>Residential location</i>	
60-64	23.6	Urban	76.7
65-69	24.5	Rural	23.3
70-74	18.7		
75-79	14.3	<i>Regional location</i>	
80-84	10.8	North England	29.2%
85+	8.1	The Midlands	18.7%
<i>Marital status</i>		East England	12.0%
Married/Cohabiting	66.0	South England	28.7%
Single	5.2	London	11.4%
Separated or divorced	9.2	<i>Years living in the same area</i>	
Widowed	19.6	Under 3 yrs	10.4
<i>Employment status</i>		Under 5 yrs	5.1
Full time	11.2	Under 10 yrs	10.3
Part-time	8.4	More than 10 yrs	19.4
Retired	80.4	Always lived here	54.8
<i>Education</i>		<i>Car in the household</i>	
Degree level or above	24.3	Yes	77.8
Other types of qualification	75.7	No	22.2

153

154

155 2.2 Conceptual framework for analysis and measures

156 This study employs the conceptual framework developed by Luiu et al. (2018b) (Figure 1). The
 157 framework is developed to improve the evaluation of travel needs fulfilment during later life.
 158 Much research on travel needs of older people is based on Maslow's (1968) hierarchy of human

159 needs approach, where people satisfy first biology and basic needs for survival, followed by
160 psychological and self-fulfilment needs. A typical translation of Maslow's approach into
161 transport studies is the classification of travel needs as utilitarian and discretionary.
162 Musselwhite and Haddad (2018, 2010) furtherly expanded Maslow's perspective and
163 developed a hierarchy of travel needs where older people tend to fulfil first practical/utilitarian
164 needs, then social/affective needs and finally aesthetic needs (kinaesthetic, immersive and
165 imaginative mobility).

166 A different approach used to investigate travel needs fulfilment generates from Allardt's (1993)
167 theory of integral needs. This approach has been employed particularly by Scandinavian
168 scholars and considers travel needs satisfaction according to three different conditions of life:
169 1) having (*e.g.* commuting, shopping, health); 2) loving (*e.g.* visiting family and friends); 3)
170 being (*e.g.* leisure activities). An important characteristic of Allardt's applied approach is that
171 activities do not belong to pre-fixed categories, but can help to fulfil different conditions of
172 life.

173 In their review, Luiu et al. (2017) concluded that their analysis was inconclusive in identifying
174 which factors lead to unmet travel needs due to both differences in research approaches and
175 the heterogeneity characterising older people. Consequently, they developed a framework that,
176 rather than being based on a specific theoretical approach, builds on an extensive literature
177 review that identifies a set of factors that should be taken into consideration when investigating
178 the mobility of the older people. The result is a construct of five interrelated domains of
179 qualitative and quantitative variables that shape and influence mobility in later life.

180



181

182 **Figure 1.** Conceptual framework to assess travel needs in later life (Luiu et al., 2018b)

183

184 The “Transportation” domain assesses individual resources and abilities for transport mobility
 185 by investigating travel patterns and access to transport modes, attitudes towards transportation,
 186 coping strategies for those not driving and trip planning. The “Health and wellbeing” domain
 187 assesses health conditions and life satisfaction from both a subjective and objective point of
 188 view, in addition to exploring the relationship between the type of impairment and difficulties
 189 in undertaking activities and using transport modes. The “Built environment” domain assesses
 190 spatial characteristics in terms of contextual conditions of the place of residence not only from
 191 a general point of view such as urban, suburban or rural, but also with a more defined range of
 192 settlements spatial characteristics. Moreover, this domain investigates the accessibility of the
 193 built environment regarding access to transport resources, service facilities and goods, and
 194 quality of the infrastructural features provided. The “Activity domain” assesses the type of
 195 activity and the extent of engagement with activities that older people have, in addition to how
 196 these are perceived in terms of importance. Finally, the “Demographics” domain assesses
 197 individuals’ background demographic characteristics about individual characteristics, socio-

198 economic factors, living form and environment and social network.

199 2.3 Measures

200 The measures identified for the study were selected from the NTS survey in accordance with
201 the five domains of Luiu et al's (2018) framework. Transportation measures comprised of
202 factors related to access to transport resources and barriers in using transport modes. These
203 include travel frequencies with the car, bus, train, walking, cycling and taxi (*3 or more times a*
204 *week; once or twice a week; once or twice a month; less than twice a month; once or twice a*
205 *year; less than once a year*); access to the car in the household; holding a driving licence and
206 reason for driving cessation; car usage (*driver or passenger*); holding a concessionary pass for
207 public transport and whether participants had difficulties in using the car, the bus and walking.

208 Health and wellbeing measures included whether participants had general mobility difficulties
209 and if such impairments/disabilities affected travelling by car, bus and walking.

210 The built environment was measured in terms of participants' regional location of residence
211 (*London, North England, The Midlands, East England and South England*); context of the
212 residential location (*urban or rural*); and minutes to walk to the nearest public transport stop
213 (*less than 7 minutes; 7 minutes or more*).

214 Activities were measured in terms of whether participants had difficulties in undertaking out-
215 of-home activities and the barriers preventing them from doing so. Activities investigated were:
216 1) travelling to doctors/hospitals; 2) visiting friends or relatives; 3) travelling to other social
217 activities; 4) travelling to school/college/university; 5) taking children to school and 6)
218 travelling for any other reason. Barriers to carry out these activities included: (i) too far/long
219 journey; (ii) journey not possible by public transport; (iii) cost of using public transport/taxis;
220 (iv) poor information about public transport; (v) poor connections; (vi) public transport
221 unpleasant; (vii) not holding a driving licence; (viii) cost of petrol; (ix) lack of parking

222 facilities; (x) cost of parking; (xi) personal disability; (xii) concern over personal safety and
223 (xiii) traffic congestion.

224 Finally, Demographic measures draw on the standard characteristics used to provide an outline
225 profile of the participants. Measures for this domain included age; gender, marital status (*living*
226 *with a spouse/partner; living alone/widowed*); income (*less than £25,000; £25,000 to £49,999;*
227 *£50,000 and over*); employment status (*working full-time; working part-time; retired/other*
228 *non-working*); education (*degree or above; other types of qualifications*) and length of
229 residence in the current house (*under 3/5/10 years; more than 10 years; always lived here*).

230 2.4 Data analysis

231 Data from the NTS 2016 were analysed with the help of IBM Statistical Packages of Social
232 Sciences 26 (SPSS) and the analysis included descriptive statistics and a set of four binomial
233 logistic regressions. Descriptive analysis comprising frequencies and cross-tabulations was
234 employed to investigate respondents transport resources and travel difficulties with mode usage
235 and undertaking out-of-home activities. The analysis followed the instruction from the NTS
236 data extraction user guide (Department for Transport, 2017) with weighting procedures applied
237 for the interview sample.

238 The regression analysis was carried out to understand the impact of the factors affecting travel
239 difficulties among older people and was formulated based on the question: “*Do you have any*
240 *transport difficulties for any of these types of journey?*”. Dependent variables for the analysis
241 were out-of-home activities in general and those that emerged from the descriptive analysis
242 were older people reported more difficulties, *i.e.* visiting hospital/GP, visiting other people or
243 relatives in their houses and social activities. As the dependent variables have a dichotomous
244 value (*yes and no*), the binary logistic regression was employed as the appropriate model for
245 the analysis (McFadden, 1973). The independent variables were identified according to four

246 remaining domains of the framework highlighted in Section 3.2 (*i.e.* transportation, health,
247 built environment and demographics.). In addition to the objective indicators associated with
248 these domains, the study follows the approach from Kim (2011a), Nordbakke and Schwanen
249 (2015) and Kim et al. (2014) and includes also subjective indicators to provide a better
250 understanding of the degree to which older people experience difficulties in carrying out
251 activities.

252 As required for this type of analysis, the independent variables were checked for
253 multicollinearity and tested by calculating the variance inflation factors (VIFs). On this basis,
254 the following variables were not included in the models among the subjective indicators: poor
255 information about public transport, public transport unpleasant, not holding a driving licence,
256 cost of petrol, cost of parking. Among the objective indicators, holding a driving licence was
257 also excluded due to the high correlation with access to the car in the household and car usage
258 characteristics (*i.e.* driver or passenger). Although holding a driving licence is usually preferred
259 over access to the car as a measure to assess car impacts (see Nordbakke, 2019), the NTS
260 survey provides a differentiation in how people access the car either as a driver or a passenger,
261 and therefore potentially better explain the impact of the car for transport disadvantages.
262 Finally, given the relatively little variation in the sample, distance from the nearest public
263 transport stop was also excluded from the regression analysis. Table 2 provides an overview of
264 the independent variables employed for the binomial logistic regression analysis and the
265 association of each variable with its domain of the framework.

266

267

268

Table 2. Overview of the independent variables and associated domains of the framework

Independent variables / Domains	<i>Demographics</i>	<i>Health and wellbeing</i>	<i>Built environment</i>	<i>Transportation</i>
Age	X			
Gender	X			
Living status	X			
Education	X			
Working status	X			
Income	X			
Length of residence in same area	X			
Health problems with walking		X		
Health problems with bus		X		
Health problems with car		X		
Regional location			X	
Context of residential location			X	
Car access as driver				X
Car access as passenger				X
No access to the car				X
Holding concessionary pass				X
Concerns over personal safety		X		
Too far / long journey			X	
Lack of parking facilities			X	
Traffic congestion			X	
Journey not possible by public transport				X
Unreliable public transport				X
Cost of using public transport / taxis				X
Poor connections				X

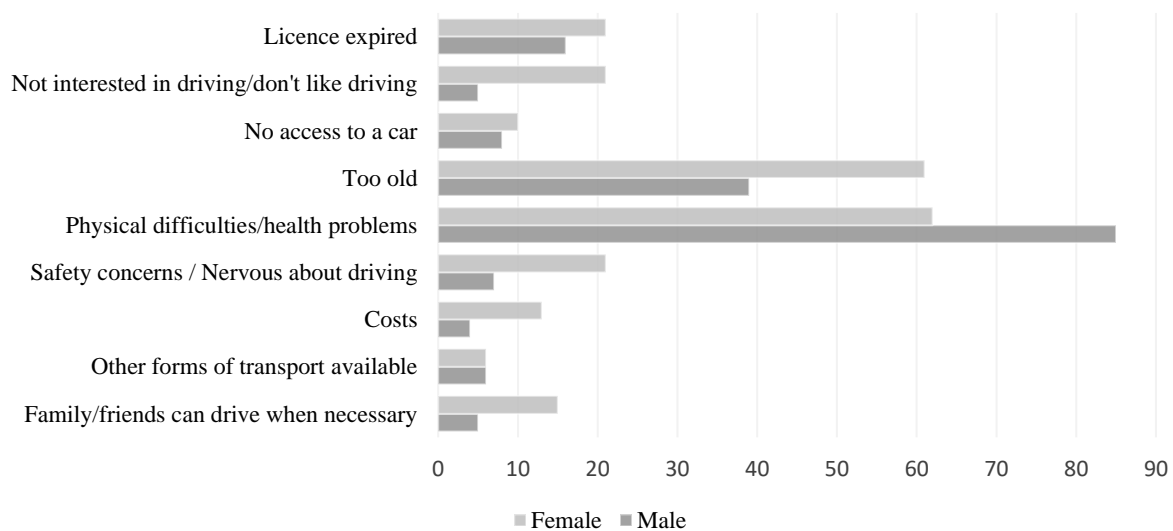
270

271 **3 Results**272 *3.1 Access to transport resources*

273 The descriptive statistics analysis suggest that the car plays a relevant role in older people's
274 everyday mobility. The car is the most used transport mode with more than two-thirds (68.4%)
275 of respondents travelling with this mode three or more times per week and 17.4% at least once
276 a week. More than three-quarters of the participants had access to at least one car in their
277 household (78.9%) and hold a driving licence (72.9%). Around half of them use the car as the
278 main driver, while 10.5% just as passengers that do not drive. Older men are more likely to use
279 the car as main drivers (34.4% *versus* 22.3%), while older women are more represented as the

280 other driver in the household (3.3% *versus* 8.5%) or passengers that do not drive (2.2% *versus*
 281 8.2%). Similarly, the percentage of women with no driving licence is three times bigger than
 282 their counterpart (20.2% *versus* 7.1%). Both car access and driving licence decrease with age,
 283 with 80 years old as a turning point.

284 A notable gender differentiation to car usage is also present in the reasons for driving cessation
 285 and explain the differences between women and man in car usage (Figure 2). Overall, physical
 286 impairment/health problems (35.6%) and being too old (24.3%) were stated as the main reasons
 287 for not holding a driving licence. However, while men reported to having to stop driving mainly
 288 due to health reasons, women mentioned as main reasons feeling too old, safety concerns and
 289 feeling nervous about driving, availability of lifts from family and friends and costs associated
 290 with driving.



291

292 **Figure 2.** Reasons for driving cessation

293 People living in urban environment have less access in their household to a car compared to
 294 those living in rural areas (74.5% *versus* 88.7%) and travel less frequently with the car. On the
 295 other hand, data indicate they have better access to public transport. Overall, the vast majority
 296 of the respondents mentioned to live within 6 minutes walking distance from a bus stop and

297 two-thirds of them hold a concessionary bus and/or train pass. Nonetheless, while around 20%
 298 of urban dwellers stated to travel by bus at least three times or more per week, only 4.8%
 299 mention the same in rural areas. Older women use the buses almost as twice as men, while
 300 frequency tends to decline with age for both gender groups, again with 80 years old as a turning
 301 point.

302 *3.2 Travel difficulties and barriers associated with transport modes*

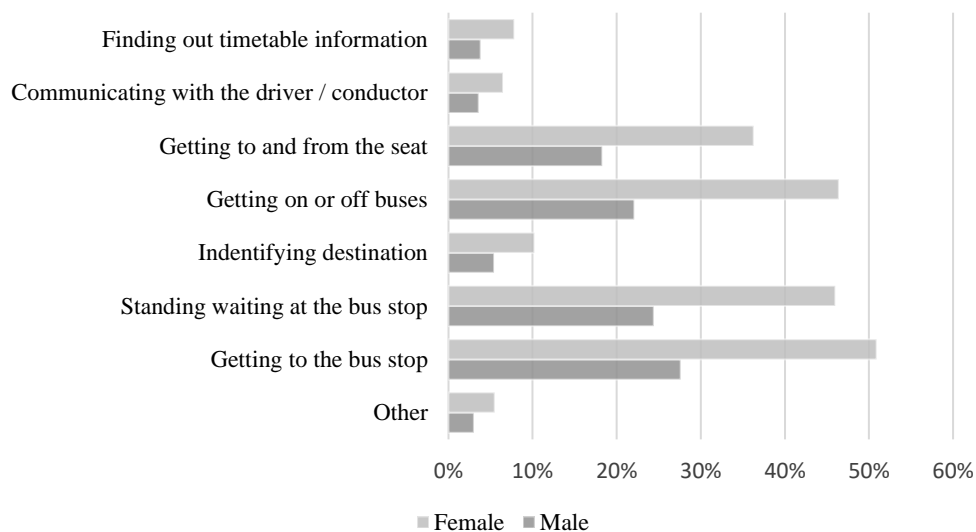
303 Looking at the travel difficulties and barriers experienced in their out-of-home mobility, around
 304 a quarter of the respondents reported having issues with transport modes. Data indicate that
 305 walking is the most affected mode in this sense. However, older people tend to experience
 306 difficulties with more than one mode at the same time rather than single ones, especially when
 307 walking is involved (Table 3). Older women have more difficulties than men, especially when
 308 walking and using the bus to travel, difficulties increase with age, but less about car usage.

309 **Table 3.** Travel difficulties per selected mode and combination of modes for gender and age groups

	Walking	Bus	Car	Walking + Bus + Car	Walking + Bus	Walking + Car	Bus + Car	Walking only	Bus only	Car only
<i>Male</i>	7.8%	5.5%	4.3%	3.2%	1.7%	0.5%	0.0%	2.4%	0.6%	0.6%
<i>Female</i>	12.4%	10.4%	7.7%	5.8%	3.2%	0.7%	0.4%	2.7%	1.0%	0.8%
<i>Total</i>	20.1%	15.9%	12.0%	9.0%	4.8%	1.2%	0.5%	5.1%	1.6%	1.3%
<i>60-65</i>	9.5%	8.0%	5.9%	4.3%	2.1%	0.6%	0.3%	2.6%	1.4%	0.7%
<i>66-70</i>	12.5%	8.6%	7.6%	4.6%	2.8%	1.6%	0.6%	3.5%	0.6%	0.8%
<i>71-75</i>	18.2%	13.8%	10.9%	7.1%	4.4%	1.3%	0.5%	5.4%	1.8%	2.0%
<i>76-80</i>	23.1%	17.3%	13.4%	9.7%	5.3%	1.1%	0.4%	7.0%	1.9%	2.2%
<i>81-85</i>	37.1%	29.1%	20.5%	16.6%	9.7%	2.1%	0.5%	8.7%	2.3%	1.3%
<i>85+</i>	50.7%	44.8%	31.7%	28.5%	12.4%	0.8%	0.8%	9.0%	3.1%	1.6%

310
 311 A potential explanation for these findings might be related to the impact of health issues on
 312 mobility. It is commonly acknowledged that health deteriorates with ageing and therefore older
 313 people are more likely to experience difficulties due to declining of health functions. While the

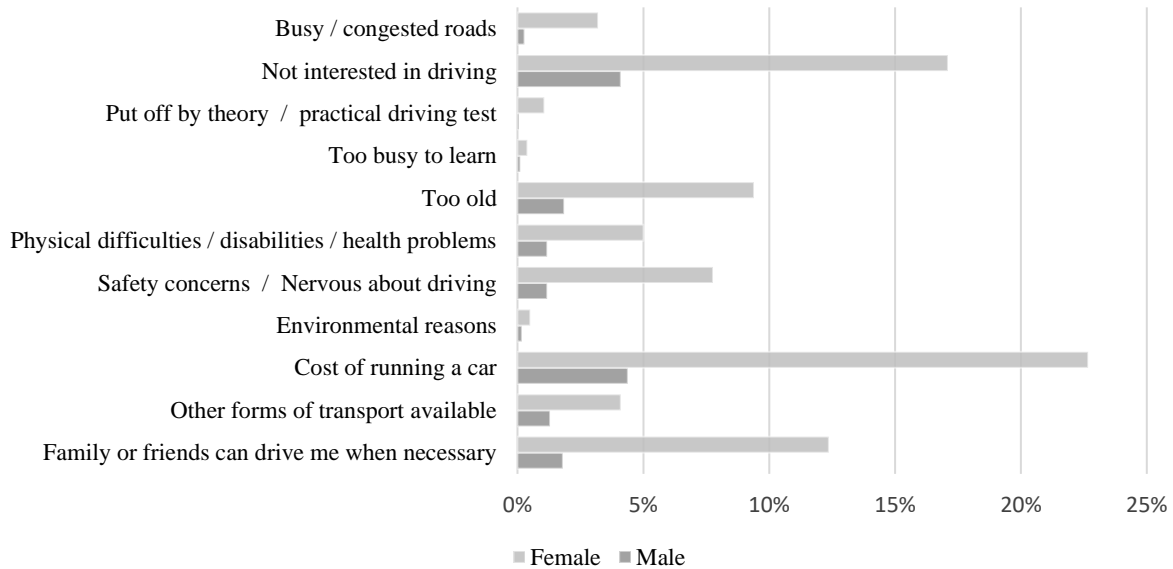
314 implications of having difficulties with walking due to the deterioration of sensory, cognitive
 315 and physical functions (Tournier et al., 2016) are more obvious as walking is an active transport
 316 mode, the analysis reveals that poor health impacts also bus usage. As shown in Figure 3, of
 317 those reporting difficulties with using the bus (15.9% overall), the main reasons stated included
 318 getting to the bus stop, standing while waiting at the bus stop, getting in and out of the bus and
 319 to and from a seat. Basically, all actions that require physical effort and involvement. Health
 320 reasons were also, together with being too old, the main barriers reported for not cycling more
 321 during later life. Other barriers included concerns about road safety (8.6%), not having a bike
 322 (8.6%), too much traffic (7.4%) and having a car/easier to travel by car (7.0%).



323
 324 **Figure 3.** Travel difficulties experienced while travelling by bus

325
 326 Interestingly, having health issues was not amongst the main barriers linked to car usage
 327 (Figure 4). Of those asked why they do not drive more (32.8%), only 6.2% reported not doing
 328 so due to physical difficulties. This finding confirms again one of the positives of using the car
 329 in later life, which is the compensation for the limiting effects of health issues on the ability to
 330 carry out daily activities (Siren and Hakamies-Blomqvist, 2004). The cost involved to run a car
 331 was reported as the main barrier to car usage, followed by lack of interested/no need of driving

332 and availability of family and friends to get a lift. The data show again a significant gender
 333 difference experienced in barriers associated with car usage.



334
 335 **Figure 4.** Barriers to car usage
 336

337 *3.3 Travel difficulties and barriers associated with carrying out activities*

338 The other aspect that was analysed in terms of travel difficulties was related to understanding
 339 which barriers impact out-of-home activities and which of these activities are more affected
 340 during later life. Table 4 shows a descriptive analysis of the travel difficulties associated with
 341 carrying out-of-home activities cross-tabulated by the independent variables employed in the
 342 binomial logistic regression analysis. Travel difficulties are linked to gender, marital status,
 343 education level, household income, health conditions and car accessibility. As per access to
 344 transport and travel difficulties with transport modes, older women have more difficulties in
 345 carrying out activities than older men. Older people living alone or widowed have a higher
 346 percentage of travel difficulties, as the likelihood of having company and the chances of getting
 347 a lift are reduced compared to those living with a spouse/partner. Household income and
 348 education level suggest that the chances of experiencing travel difficulties are higher with lower
 349 incomes and education level.

350 Table 4 confirms that older people with health problems affecting their transport have more
351 difficulties in carrying out activities, particularly walking difficulties. Similarly, car
352 accessibility is linked with travel difficulties, particularly for those older people with no access
353 to the car in their household and not driving. Interestingly, none of the built environment
354 characteristics are linked with travel difficulties. Both regional and residential areas show little
355 difference between older people experiencing and not having travel difficulties, although data
356 indicate that the former live predominantly in urban contexts, in the Northern and Southern
357 part of the country and are ageing in place (years lived in the local community).

358 Journeys to attend medical appointments, either hospital or general practitioner (GP), visiting
359 other people and to undertake social activities were those in which older people experience
360 more difficulties. Again, having health issues was the main barrier affecting the ability to carry
361 out these three activities. Figure 5 shows also that the other main difficulties are related to bus
362 usage, particularly in terms of service availability and reliability, and distance involved for the
363 journey, especially to visit other people. Women experienced difficulties to carry out these
364 three activities more than older men do. These difficulties were particularly emphasised
365 regarding bus usage to carry out such activities.

366

367

368

369

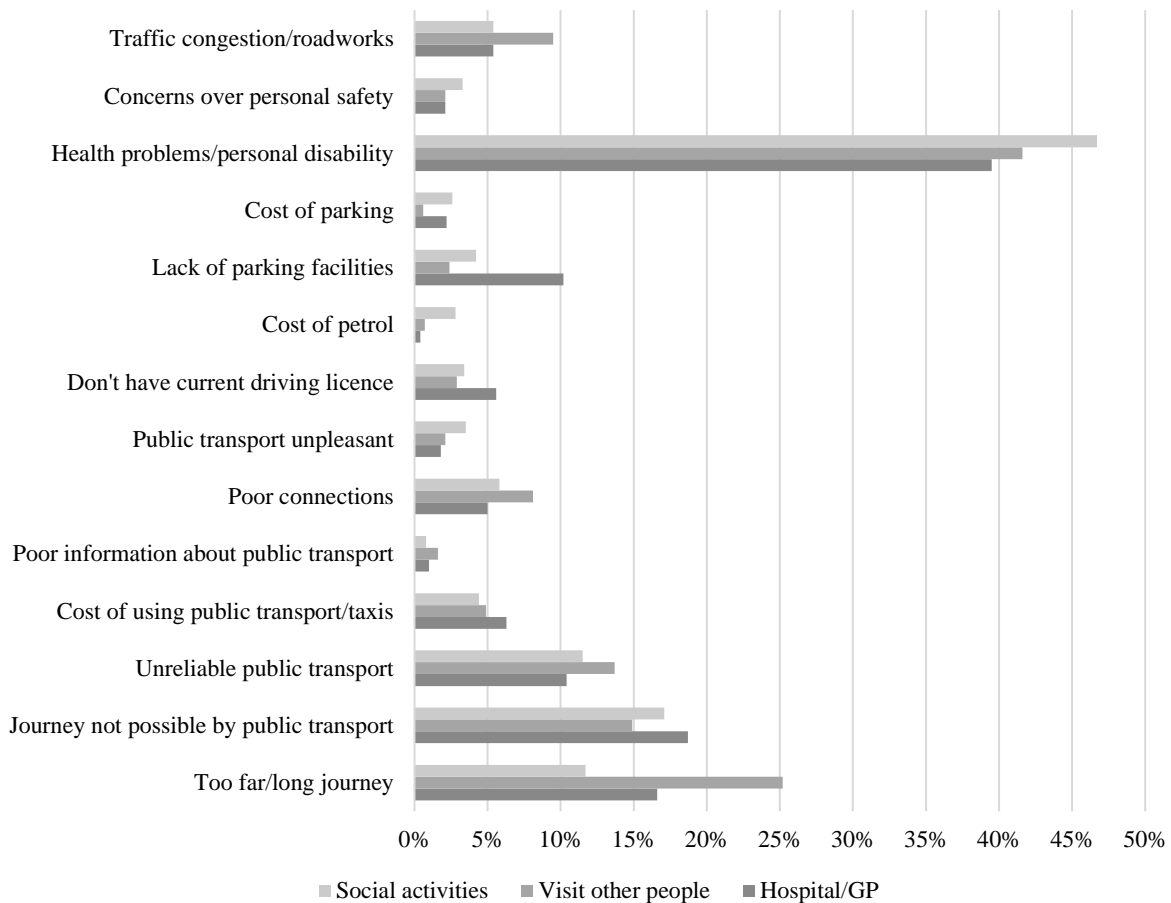
370

371

Table 4. Descriptive analysis of travel difficulties with carrying out out-of-home activities

	Value	Travel difficulties with out-of-home activities			
		Yes (<i>N</i> =660)		No (<i>N</i> =3365)	
		Frequency	Percent	Frequency	Percent
Age	Age 60 - 74	364	55.2	2319	68.9
	Age 75 and above	296	44.8	1045	31.1
Gender	Male	262	39.7	1616	48.0
	Female	398	60.3	1749	52.0
Marital status	Living w/a spouse/partner	398	60.3	2466	73.3
	Living alone/widowed	262	39.7	898	26.7
Education	Degree or above	120	27.3	545	23.7
	Other types of qualifications	319	72.7	1754	76.3
Employment status	Working full-time	41	6.2	411	12.1
	Working part-time	38	5.7	298	8.9
	Retired/other non-working	582	88.1	2655	79.0
Household Income	Less than £25,000	403	61.1	1739	51.7
	£25,000 to £49,999	160	24.2	976	29.0
	£50,000 and over	97	14.7	650	19.3
Years lived in the local community	Under 3 years	49	9.9	244	10.4
	Under 5 years	23	4.6	119	5.1
	Under 10 years	61	12.3	231	9.9
	More than 10 years	91	18.3	461	19.7
	Always lived here	272	54.8	1279	54.8
Context of residential location	Urban	530	80.2	2559	76.0
	Rural	131	19.8	806	24.0
Regional location	North	171	25.9	1008	30.0
	Midlands	129	19.5	619	18.4
	South	198	30.0	958	28.5
	East	85	12.9	399	11.9
	London	77	11.7	381	11.3
Health problems with walking	Yes	266	40.2	544	16.2
	No	395	59.8	2820	83.8
Health problems with bus use	Yes	240	36.3	399	11.9
	No	421	63.7	2966	88.1
Health problems with car use	Yes	188	28.5	296	8.8
	No	472	71.5	3069	91.2
Holding a concessionary pass	Yes	461	69.7	2110	62.7
	No	200	30.3	1254	37.3
Car usage as a driver	Yes	308	46.6	2400	71.3
	No	352	53.4	965	28.7
Car usage as a passenger	Yes	74	11.2	350	10.4
	No	586	88.8	3015	89.6
Car in the	One or more car	381	57.7	2750	81.7

373



374

375 **Figure 5.** Travel difficulties affecting out-of-home activities

376

377 In addition to the descriptive statistics, a set of binomial logistic regression analyses was
 378 undertaken to evaluate the propensity of older people to experience travel difficulties and
 379 barriers while undertaking out-of-home activities. More specifically, the analysis looked at
 380 activities in general and for the three activities with most reported travel difficulties, *i.e.*
 381 journeys to hospital and GPs, visit other people and social activities. The results from the
 382 logistic regressions confirm some of the findings from the descriptive analysis, especially about
 383 the impact of health, poor access to transport resources and gender.

Table 5. Logistic regression analysis of travel difficulties to carry out out-of-home activities

	Activities in general		Hospital and GPs		Visit other people		Social activities	
	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>
Age	-0.074		-0.025		0.115		-0.124	
Gender	-0.297**		-0.303*		-0.194		-0.321*	
Marital status	0.040		0.055		-0.061		0.051	
Education	-0.046***		-0.038**		-0.020		-0.040**	
Employment status	-0.028		-0.137		-0.062		-0.175	
Household income	0.049		0.103		-0.122		0.120	
Length of residence	-0.031		-0.033		0.080		-0.030	
Regional location	-0.043		-0.017		-0.026		-0.023	
Context of residential location	-0.064		-0.166		0.145		-0.029	
Health problems - Walking	0.439*		0.683**		0.858**		0.664***	
Health problems - Bus	0.725***		0.617**		0.593*		0.606**	
Health problems - Car	0.577**		0.386		0.027		0.618**	
Car usage - driver	-0.262		-0.359		0.400		-0.367	
Car usage - passenger	-0.300		-0.274		0.535		-0.309	
No access to the car	-1.136***		-1.031**		-0.194**		-1.122***	
Holding a concessionary pass	-0.274*		-0.275		-0.079		-0.232	
Concerns over personal safety			0.354		3.527*		2.687**	
Too far / long journey			2.063***		2.796***		1.375*	
Lack of parking facilities			3.788***		3.027		2.913**	
Traffic congestion			3.234***		4.040***		1.731	
Journey not possible by PT			2.616***		2.331***		1.614	
Unreliable PT			2.988***		3.399***		1.552	
Cost of using PT/taxis			2.918*		2.260**		-4.046	
Poor connections			1.283		2.319**		2.150*	
<i>Model fit</i>								
Chi-square		299		497		394		372
<i>p</i> value		0.000		0.000		0.000		0.000
<i>R-square</i>								
Cox & Snell		0.100		0.161		0.130		0.123
Nagelkerke		0.166		0.295		0.335		0.217

385 * $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$

386 Table 5 shows that gender, education, health issues affecting walking and both bus and car
387 usage, lack of access to a car in the household and not holding a concessionary bus pass were
388 found to be predictors of experiencing travel difficulties while undertaking out-of-home
389 activities in general. The regression analysis of the three selected activities produced similar
390 results for the activities in general, although with some differences. Gender and education have
391 an impact on journeys to hospital and social activities, but show no effect on visiting other

392 people. Health problems with walking and buses were found to affect all three activities, while
393 health issues associated with car usage affected social activities. Health difficulties emerged to
394 be associated also with wellbeing issues, as having concerns over personal safety affected
395 visiting other people. Journeys to visit other people were also those affected the most from poor
396 access to transport resources, as all variables but using the car as the main driver and holding
397 a concessionary pass were found to be statistically significant. On the opposite, social activities
398 were those less impacted in this sense, with travel difficulties being mainly impacted by public
399 transport availability and reliability, in addition to no access to the car. Overall, all subjective
400 indicators employed in the logistic regression analyses were found to be effective in predicting
401 travel difficulties. This was particularly valid for journeys to visit other people, as all subjective
402 indicators apart from lack of parking facilities were statistically significant. Moreover, the
403 length of the journey, traffic congestion, unreliability and availability of public transport were
404 the variables affecting all three activities.

405 **4 Discussion**

406 This study investigated the factors leading to experiencing travel difficulties amongst the older
407 population in England and how the NTS is covering the issue of travel difficulties. The study
408 contributes to the existing academic literature in several ways. First, it identifies poor health
409 and wellbeing, lack of access to transport resources and gender as the main predictors to
410 experiencing travel difficulties in later life. One-third of respondents aged 60 years old and
411 above reported to have health impairments affecting both using transport modes and carrying
412 out activities. Walking was the transport mode more affected in this regard, due to the
413 implications of being an active travel option. Nonetheless, links of travel difficulties between
414 both bus and car usage and health issues emerged from the analysis. Looking at the bus, the
415 majority of the difficulties reported were related to health impairments/disability and included
416 problems to reach and stand at the bus stop, boarding and alighting the bus and getting to and

417 from a seat. More than a third of those that stopped driving did so due to health reasons, which
418 was also stated amongst the first five reasons for not driving more. Similarly, health was the
419 main barrier to carry out activities, with around 40 to 45% of respondents experiencing travel
420 difficulties to visit GP/hospitals, other people and family relatives in their houses and social
421 activities. The logistic regression analysis confirmed the impact of health on the mobility of
422 older people as difficulties in using the bus and walking due to impairment/physical disabilities,
423 were found to be statistically significant in all activities investigated. Moreover, health-related
424 difficulties with using the car were found to affect activities in general and social activities.
425 Importantly, health-associated difficulties are not only a matter of physical impairments or
426 disabilities, but also of wellbeing. Concern over personal safety emerged as one of the
427 predictors for experiencing travel difficulties to visit other people and relatives and was stated
428 amongst the main reasons for driving cessation (especially from women) and cycling more.

429 The lack of access to transport resources is the second main factor contributing to experiencing
430 travel difficulties. The role of the car for fulfilling travel needs in later life has been highlighted
431 in the vast majority of studies investigating this topic (see Luiu et al., 2018a; Musselwhite and
432 Haddad, 2010; Nordbakke, 2019, 2013; Nordbakke and Schwanen, 2015; Siren and Haustein,
433 2014; Ward et al., 2013). The analysis from the logistic regression indicates that not having
434 access to a car in the household is a strong predictor of travel difficulties as it was found to be
435 statistically significant for all the activities analysed. Interestingly, driving a car had opposite
436 results. This finding suggests that when both driving role and access to the car are taken into
437 account in the analysis, the latter is a stronger predictor for transport disadvantages. Moreover,
438 it might explain why having family and/or friends that can ferry individuals around was the
439 second most reported reason for not driving more. In this light, shifting from driving to being
440 a passenger was identified as the preferred option for older people to carry out their activities
441 in several studies looking at driving cessation and alternative ways of travelling (Davey, 2007;

442 Kim, 2011b; Luiu et al., 2018c). However, a factor that rarely emerges from studies looking at
443 the impact of the car on unmet travel needs or travel barriers is the understanding of how easy
444 it is for those that do not drive to get a lift whenever they need or want. For example, Luiu et
445 al. (2018a) highlighted that having access to the car in the household does not automatically
446 imply the ability to use it, and found that a third of participants were not able to do so easily.

447 Similarly to the car, poor access to public transport resources increases the chances of
448 experiencing travel difficulties. Holding a concessionary pass for public transport or subsidised
449 token was found statistically significant to carry out activities in general. Moreover, public
450 transport availability, unreliability and poor connections were amongst the most reported
451 difficulties to carry out the three selected activities in the descriptive analysis and found to be
452 significant in the regression analysis. Another interesting finding from the subjective indicators
453 in the regression analysis was the impact of the cost of public transport and taxi in both carrying
454 out medical journeys and visiting other people and relatives. The NTS survey does not make
455 explicit which of the modes have more impact between the taxi and public transport.
456 Nonetheless, this finding is in line with other studies indicating affordability as one of the main
457 barriers to use the taxi (Luiu et al., 2018c; WS Atkins, 2001) and that such a mode is used
458 sporadically for specific journeys such as attending medical appointments or special occasions
459 (Glasgow and Blakely, 2000; Knight et al., 2007).

460 Gender is the third main barrier leading to travel difficulties. Together with education, gender
461 is the only variable from the Demographics domain showing statistical significance for all
462 activities but visiting other people. The descriptive statistics show that older women experience
463 overall more travel difficulties than their counterparts do. Data show that they have more health
464 issues affecting mobility than men, especially for using the bus and going out on foot. The
465 number of women with no licence was almost three times bigger than men, while in terms of

466 car access they are at least twice as likely as men to not be the primary driver, just a passenger
467 or not having access to a car in the household at all. Reasons for not driving more show also
468 differences in gender, especially for getting a lift from others, safety and feeling nervous, and
469 feeling too old for driving. These findings on driving cessation are in line with previous studies
470 highlighting that while male drivers tend to drive until they are either stopped by doctors or
471 health issues, older women are more concerned of other issues other than health and decide to
472 give up driving spontaneously (Haustein et al., 2013; Hjorthol, 2013).

473 It is important to mention that experiencing transport difficulties does not automatically imply
474 transport-related social exclusion or unmet travel needs, as it is still possible to fulfil travel
475 needs or be socially included despite having such difficulties. Still, these findings indicate that
476 older people at most risks of experiencing travel difficulties fit within the cluster that Luiu
477 (2019) identifies as “unfulfilled seniors”. This group is characterised by older people having
478 unmet travel needs and consequently low engagement in activities and societal participation.
479 Moreover, they are usually captive to public transport, flexible transport services or car
480 passenger users, suffer from poor health conditions and more often are women and belong to
481 the oldest cohorts of older adults.

482 Another important contribution of this study is the employment of subjective indicators in
483 addition to objective variables to better explain which factors lead to experiencing travel
484 difficulties. Kim et al. (2014) used subjective indicators (identified as latent factors) to
485 investigate unmet travel needs amongst South Korean older adults. They carried out a set of
486 logistic and ordinal regression analyses and found that the models with the latent factors were
487 statistically superior to those without. Similarly, Nordbakke and Schwanen (2015) found that
488 subjective indicators were considerably more effective to understand unmet travel needs
489 compared to all the other variables involved in their analysis. Our findings are in line with these

490 two studies, as all subjective indicators were found to be statistically significant along with the
491 binomial logistic regression analysis. This was particularly valid for those indicators related to
492 quality and service provision of public transport and features of the built environment. In their
493 review, Luiu et al. (2017) highlight that factors belonging to the built environment domain
494 were the most controversial to understand unmet travel needs. The results from this study
495 confirm that living context (region and urban/rural) does not affect travel difficulties, as found
496 in previous research (Haustein and Siren, 2014; Hjorthol, 2013; Nordbakke and Schwanen,
497 2015; Scheiner, 2006). On the other hand, the built environment can increase the chances of
498 experiencing travel difficulties when the quality of the infrastructure is poorly provided. The
499 binomial logistic regression analysis shows that issues associated with lack of parking facilities,
500 traffic congestion and long journeys are predictors for travel difficulties. Nordbakke (2013)
501 found similar results, indicating that the quality of facilities can either be a barrier or option for
502 mobility, depending on the level of the quality provided. These findings highlight the need for
503 a deeper investigation beyond the living context to understand how the built environment
504 affects travel needs, and subjective indicators can be a more effective way of doing so.

505 Finally, this study explored how the NTS is investigating the issue of travel difficulties and
506 identifies potential gaps needed to be addressed. Four potential suggestions to improve the
507 survey having in mind older people (and vulnerable groups more in general) emerged from the
508 analysis. First, questions on travel difficulties should be included in the survey on an annual
509 basis rather than every two years. Such a shift should allow for a more robust investigation of
510 the topic, especially in terms of longitudinal analyses. Second, the activities investigated for
511 travel difficulties should match with those asked in terms of purpose of travel. Shopping is the
512 main activity older people undertake (Department for Transport, 2019), but the survey only
513 investigates difficulties with using the car for food shopping trips, with the implication that
514 other modes and types of shopping are not considered, and also different barriers to the other

515 activities are employed. Third, health-related difficulties investigated are only those associated
516 with physical and mobility impairments/disabilities. Subjective evaluations of individuals'
517 health and mobility, and more in general wellbeing, should also be taken into account when
518 assessing travel difficulties (and mobility in general), as several studies found these as potential
519 indicators for unmet travel needs (Haustein and Siren, 2014; Hjorthol, 2013; Luiu et al., 2018a).
520 Lastly, the survey should draw largely from barriers identified in the literature looking at unmet
521 travel needs and social exclusion to better understand potential travel difficulties. Barriers often
522 overlooked that might provide a better understanding include time, adverse weather conditions,
523 poor provision of built environment infrastructure such as lack of illumination, benches, toilet
524 facilities and pavements, and fear of falling or being harassed (Luiu et al., 2018c).

525 **5 Conclusions**

526 This study used data from the NTS 2016 to identify the difficulties that older people face in
527 their daily life in both using transport modes and undertaking out-of-home activities within the
528 English context. It identifies suffering from poor health and wellbeing conditions, having poor
529 access to transport resources (access to a car in the household, availability and quality of public
530 transport) and gender as the main predictors for experiencing travel difficulties in later life. The
531 findings from this study indicate a series of potential avenues for future policies, planning and
532 interventions targeting age-friendly and inclusive transport and environments that will allow
533 the increasing amount of older people to keep active and engaged in society. This particularly
534 in a context where “ageing society” and “future of mobility” are two of the four UK grand
535 challenges for research and innovation (Department for Business Energy & Industrial Strategy,
536 2019).

537 As transport-related variables alone are not enough to explain travel difficulties (and more in
538 general unfulfilled mobility), there is a need to shift from a traditional, silo-based view and
539 employ a more holistic and intersectionality-based approach to understand what affects and

540 shapes mobility in later life. The framework employed in this study provides a potential way
541 of doing so, but more research needs to be done on this subject. Similarly, a focus only on
542 realised mobility does not capture all potential mobility issues faced by individuals, especially
543 of those belonging to vulnerable groups. Traditional surveys should incorporate questions
544 looking at needed or desired journeys that for some reason are not achievable, so that both
545 dimensions of mobility (fulfilled and unfulfilled) are taken into account.

546 The importance of the car for the independence and wellbeing of older people has been stressed
547 in several studies looking at travel needs in later life, and this study confirms such a role. Still,
548 there is a need to provide mobility beyond the car for those who cannot access, use and afford
549 this transport mode. Planning driving cessation was found successful for reducing the risks of
550 experiencing unmet travel needs and allowing those who stopped driving to improve their
551 knowledge on using alternative transport options available for fulfilling their needs
552 (Musselwhite, 2011). Improving individuals' attitude towards alternatives to the car represents
553 another key factor for providing a less car-dependent transport system. Training schemes for
554 public transport use, as well as direct involvement of older people through bottom-up citizen
555 engagement, might be powerful interventions to overcome such a barrier.

556 Finally, this study showed that activity-based investigation can bring to evidence a more
557 detailed insight associated with travel barriers. Scheiner (2006) indicated that a specific
558 analysis of both discretionary and utilitarian activities might produce more evidence about
559 older people's travel behaviour, needs and barriers, and Nordbakke (2019) confirmed such a
560 hypothesis. In this sense, there is a need for more in-depth investigation about the role that
561 discretionary activities play in later life as such activities are associated with unmet travel needs
562 (Luiu et al., 2017), especially for those older people with poor access to transport resources.

563

564 **Declaration of Competing Interest**

565 The authors declare that they have no known competing financial interests or personal
566 relationships that could have appeared to influence the work reported in this paper.

567 **Acknowledgements**

568 The authors are grateful for funding from The Institute for Global Innovation (IGI) of the
569 University of Birmingham, which has helped support this project.

570 This study uses data from the NTS. The NTS 2002–2016 data sets of the UK Department for
571 Transport were kindly provided by the Economic and Social Data Service (ESDS) through the
572 UK Data Archive at the University of Essex, Colchester. The original data creators, depositors,
573 copyright holders and the UK Data Archive bear no responsibility for their further analysis or
574 interpretation.

575 The authors would like also to thank two anonymous reviewers for their helpful and
576 constructive comments on an earlier draft of the article.

577

578 **References**

579 Adler, G., Rottunda, S., 2006. Older adults' perspectives on driving cessation. *J. Aging Stud.*
580 20, 227–235. <https://doi.org/10.1016/j.jaging.2005.09.003>

581 Allardt, E., 1993. Having, loving, being: An alternative to the Swedish model of welfare
582 research. *Qual. life* 8, 88–95.

583 Broome, K., Nalder, E., Worrall, L., Boldy, D., 2010a. Age-friendly buses? A comparison of
584 reported barriers and facilitators to bus use for younger and older adults. *Australas. J.*
585 *Ageing* 29, 33–38. <https://doi.org/10.1111/j.1741-6612.2009.00382.x>

586 Broome, K., Worrall, L., Fleming, J., Boldy, D., 2013. Evaluation of age-friendly guidelines
587 for public buses. *Transp. Res. Part A Policy Pract.* 53, 68–80.
588 <https://doi.org/10.1016/j.tra.2013.05.003>

589 Broome, K., Worrall, L., McKenna, K., Boldy, D., 2010b. Priorities for an Age-Friendly Bus
590 System. *Can. J. Aging/La Rev. Can. du Vieil.* 29, 435–444.
591 <https://doi.org/doi:10.1017/S0714980810000425>

592 Buys, L., Snow, S., van Megen, K., Miller, E., 2012. Transportation behaviours of older
593 adults: An investigation into car dependency in urban Australia: Transportation

- 594 behaviours of older adults. *Australas. J. Ageing* 31, 181–186.
595 <https://doi.org/10.1111/j.1741-6612.2011.00567.x>
- 596 Church, A., Frost, M., Sullivan, K., 2000. Transport and social exclusion in London. *Transp.*
597 *Policy* 7, 195–205.
- 598 Coughlin, J.F., 2009. Longevity, lifestyle, and anticipating the new demands of aging on the
599 transportation system. *Public Work. Manag. Policy* 13, 301–311.
600 <https://doi.org/10.1177/1087724X09335609>
- 601 Davey, J.A., 2007. Older people and transport: coping without a car. *Ageing Soc.* 27, 49.
602 <https://doi.org/10.1017/s0144686x06005332>
- 603 Delbosc, A., Currie, G., 2011. Exploring the relative influences of transport disadvantage and
604 social exclusion on well-being. *Transp. Policy* 18, 555–562.
605 <https://doi.org/10.1016/j.tranpol.2011.01.011>
- 606 Department for Business Energy & Industrial Strategy, 2019. The Grand Challenges [WWW
607 Document]. URL [https://www.gov.uk/government/publications/industrial-strategy-the-](https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges)
608 [grand-challenges/industrial-strategy-the-grand-challenges](https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges)
- 609 Department for Transport, 2019. National Travel Survey: England 2018.
- 610 Department for Transport, 2017. National Travel Survey Data Extract User Guide, 1995-
611 2016.
- 612 Evans, E.L., 2001. Influences on mobility among non-driving older Americans. *Transp. Res.*
613 *Circ. E-C026* 151–168.
- 614 Farquhar, M., 1995. Elderly people's definitions of quality of life. *Soc. Sci. Med.* 41, 1439–
615 1446. [https://doi.org/http://dx.doi.org/10.1016/0277-9536\(95\)00117-P](https://doi.org/http://dx.doi.org/10.1016/0277-9536(95)00117-P)
- 616 Fiedler, M., 2007. Older people and public transport, Challenges and changes of an ageing
617 society. Final report.
618 http://www.emta.com/IMG/pdf/Final_Report_Older_People_protect.pdf. European
619 Metropolitan Transport Authorities, Köln.
- 620 Gabriel, Z., Bowling, A., 2004. Quality of life from the perspectives of older people. *Ageing*
621 *Soc.* 24, 675–691.
- 622 Gilhooly, M., Hamilton, K., O'Neill, M., Gow, J., Webster, N., Pike, F., Bainbridge, D.,
623 2002. Transport and ageing: extending quality of life for older people via public and
624 private transport,
625 [http://bura.brunel.ac.uk/bitstream/2438/1312/1/PDF%20ESRC%20Transport%20Final%](http://bura.brunel.ac.uk/bitstream/2438/1312/1/PDF%20ESRC%20Transport%20Final%20Report.pdf)
626 [20Report.pdf](http://bura.brunel.ac.uk/bitstream/2438/1312/1/PDF%20ESRC%20Transport%20Final%20Report.pdf).
- 627 Glasgow, N., Blakely, R.M., 2000. Older nonmetropolitan residents' evaluations of their
628 transportation arrangements. *J. Appl. Gerontol.* 19, 95–116.
- 629 Haustein, S., Siren, A., 2014. Seniors' unmet mobility needs – how important is a driving
630 licence? *J. Transp. Geogr.* 41, 45–52.
631 <https://doi.org/http://dx.doi.org/10.1016/j.jtrangeo.2014.08.001>
- 632 Haustein, S., Siren, A., Franke, E., Bell, D., Pokriefke, E., Alauzet, A., Marin-Lamellet, C.,
633 Armoogum, J., O'Neill, D., 2013. Demographic change and transport. European
634 Commission.

- 635 Hine, J., Mitchell, F., 2003. Transport disadvantage and social exclusion: exclusionary
636 mechanisms in transport in urban Scotland. Routledge.
- 637 Hjorthol, R., 2013. Transport resources, mobility and unmet transport needs in old age.
638 Ageing Soc. 33, 1190–1211. <https://doi.org/doi:10.1017/S0144686X12000517>
- 639 Ipingbemi, O., 2010. Travel characteristics and mobility constraints of the elderly in Ibadan,
640 Nigeria. J. Transp. Geogr. 18, 285–291. <https://doi.org/10.1016/j.jtrangeo.2009.05.011>
- 641 Kim, J.-K., Ulfarsson, G., Sohn, K., 2014. Transportation Deficiencies for Older Adults in
642 Seoul, South Korea. Transp. Res. Rec. J. Transp. Res. Board 76–88.
- 643 Kim, S., 2011a. Assessing mobility in an aging society: Personal and built environment
644 factors associated with older people’s subjective transportation deficiency in the US.
645 Transp. Res. Part F Traffic Psychol. Behav. 14, 422–429.
- 646 Kim, S., 2011b. Transportation alternatives of the elderly after driving cessation. Transp. Res.
647 Rec. J. Transp. Res. Board 170–176.
- 648 Kim, S., Ulfarsson, G.F., 2004. Travel mode choice of the elderly: Effects of personal,
649 household, neighborhood, and trip characteristics, in: Transportation Research Record.
650 National Research Council, pp. 117–126. <https://doi.org/10.3141/1894-13>
- 651 Knight, T., Dixon, J., Warrener, M., Webster, S., 2007. Understanding the travel needs,
652 behaviour and aspirations of people in later life,
653 [http://webarchive.nationalarchives.gov.uk/20091003125851/http://www.dft.gov.uk/pgr/s](http://webarchive.nationalarchives.gov.uk/20091003125851/http://www.dft.gov.uk/pgr/scienceresearch/social/olderaspirations)
654 [cienceresearch/social/olderaspirations](http://webarchive.nationalarchives.gov.uk/20091003125851/http://www.dft.gov.uk/pgr/scienceresearch/social/olderaspirations).
- 655 Loukaitou-Sideris, A., Wachs, M., Pinski, M., 2019. Toward a Richer Picture of the Mobility
656 Needs of Older Americans. J. Am. Plan. Assoc. 85, 482–500.
657 <https://doi.org/10.1080/01944363.2019.1630295>
- 658 Lucas, K., 2019. A new evolution for transport-related social exclusion research? J. Transp.
659 Geogr. 81. <https://doi.org/10.1016/j.jtrangeo.2019.102529>
- 660 Lucas, K., 2012. Transport and social exclusion: Where are we now? Transp. Policy 20, 105–
661 113. <https://doi.org/10.1016/j.tranpol.2012.01.013>
- 662 Lucas, K., 2004. Running on empty : transport, social exclusion and environmental justice.
663 Policy Press.
- 664 Luiu, C., 2019. An investigation into the factors affecting urban travel needs in later life.
665 University of Birmingham.
- 666 Luiu, C., Tight, M., Burrow, M., 2018a. An investigation into the factors influencing travel
667 needs during later life. J. Transp. Heal. 11, 86–99.
668 <https://doi.org/10.1016/j.jth.2018.10.005>
- 669 Luiu, C., Tight, M., Burrow, M., 2018b. A conceptual framework to assess the unmet travel
670 needs in later life. J. Transp. Heal. 9, 321–333.
671 <https://doi.org/https://doi.org/10.1016/j.jth.2018.04.002>
- 672 Luiu, C., Tight, M., Burrow, M., 2018c. Factors preventing the use of alternative transport
673 modes to the car in later life. Sustainability. <https://doi.org/10.3390/su10061982>
- 674 Luiu, C., Tight, M., Burrow, M., 2017. The unmet travel needs of the older population: a
675 review of the literature. Transp. Rev. 37, 488–506.

- 676 <https://doi.org/10.1080/01441647.2016.1252447>
- 677 Maslow, A.H., 1968. *Toward a psychology of being*. Van Nostrand Reinhold, New York,
678 NY.
- 679 Mattson, J.W., 2010. Aging and mobility in rural and small urban areas: A survey of North
680 Dakota. *J. Appl. Gerontol.*
- 681 McFadden, D., 1973. Conditional logit analysis of qualitative choice behavior, in: Zarembka,
682 P. (Ed.), *Frontiers in Econometrics*. Academic Press, New York.
- 683 Mollenkopf, H., Hieber, A., Wahl, H.W., 2011. Continuity and change in older adults'
684 perceptions of out-of-home mobility over ten years: a qualitative–quantitative approach.
685 *Ageing Soc.* 31, 782–802.
- 686 Musselwhite, C., 2011. *Successfully giving up driving for older people*. International
687 Longevity Centre, London.
- 688 Musselwhite, C., Haddad, H., 2018. Older people's travel and mobility needs: a reflection of
689 a hierarchical model 10 years on. *Qual. Ageing Older Adults*.
- 690 Musselwhite, C., Haddad, H., 2010. Mobility, accessibility and quality of later life. *Qual.*
691 *Ageing Older Adults* 11, 25–37.
- 692 NatCen, 2017. *National Travel Survey 2016. Technical Report*. The Department for
693 Transport.
- 694 Nordbakke, S., 2019. Mobility, out-of-home activity participation and needs fulfilment in
695 later life. *Int. J. Environ. Res. Public Health* 16. <https://doi.org/10.3390/ijerph16245109>
- 696 Nordbakke, S., 2013. Capabilities for mobility among urban older women: barriers, strategies
697 and options. *J. Transp. Geogr.* 26, 166–174.
- 698 Nordbakke, S., Schwanen, T., 2015. Transport, unmet activity needs and wellbeing in later
699 life: exploring the links. *Transportation (Amst)*. 42, 1–23.
- 700 Nordbakke, S., Schwanen, T., 2014. Well-being and mobility: A theoretical framework and
701 literature review focusing on older people. *Mobilities* 9, 104–129.
- 702 Odufuwa, B.O., 2006. Enhancing Mobility of the Elderly in Sub-Saharan Africa Cities
703 through Improved Public Transportation. *IATSS Res.* 30, 60–66.
704 [https://doi.org/10.1016/s0386-1112\(14\)60156-4](https://doi.org/10.1016/s0386-1112(14)60156-4)
- 705 Páez, A., Mercado, R., Farber, S., Morency, C., Roorda, M., 2009. Mobility and Social
706 Exclusion in Canadian Communities: An Empirical Investigation of Opportunity Access
707 and Deprivation.
- 708 Preston, J., Rajé, F., 2007. Accessibility, mobility and transport-related social exclusion. *J.*
709 *Transp. Geogr.* 15, 151–160. <https://doi.org/10.1016/j.jtrangeo.2006.05.002>
- 710 Ravensbergen, L., Newbold, B., 2020. “ I wouldn ’ t want to get on the bus ”: Older Adult
711 Public Transit Use and Challenges during the COVID-19 Pandemic. *Transp. Find.* 1–5.
- 712 Risser, R., Haindl, G., Ståhl, A., 2010. Barriers to senior citizens' outdoor mobility in
713 Europe. *Eur. J. Ageing* 7, 69–80.
- 714 Scheiner, J., 2006. Does the car make elderly people happy and mobile? Settlement
715 structures, car availability and leisure mobility of the elderly. *Eur. J. Transp. Infrastruct.*

716 Res. 6, 151–172.

717 Schwanen, T., Páez, A., 2010. The mobility of older people - an introduction. *J. Transp.*
718 *Geogr.* <https://doi.org/10.1016/j.jtrangeo.2010.06.001>

719 Seiler, S., Schmidt, H., Lechner, A., Benke, T., Sanin, G., Ransmayr, G., Lehner, R., Dal-
720 Bianco, P., Santer, P., Linortner, P., Eggers, C., Haider, B., Uranues, M., Marksteiner, J.,
721 Leblhuber, F., Kapeller, P., Bancher, C., Schmidt, R., 2012. Driving Cessation and
722 Dementia: Results of the Prospective Registry on Dementia in Austria (PRODEM).
723 *PLoS One* 7. <https://doi.org/10.1371/journal.pone.0052710>

724 Shergold, I., Parkhurst, G., Musselwhite, C., 2012. Rural car dependence: an emerging barrier
725 to community activity for older people. *Transp. Plan. Technol.* 35, 69–85.

726 Siren, A., Hakamies-Blomqvist, L., 2004. Private car as the grand equaliser? Demographic
727 factors and mobility in Finnish men and women aged 65+. *Transp. Res. Part F Traffic*
728 *Psychol. Behav.* 7, 107–118. <https://doi.org/http://dx.doi.org/10.1016/j.trf.2004.02.003>

729 Siren, A., Haustein, S., 2015. How do baby boomers' mobility patterns change with
730 retirement? *Ageing Soc.* 36, 1–20.

731 Siren, A., Haustein, S., 2014. What are the impacts of giving up the driving licence? *Ageing*
732 *Soc.* 1–18. <https://doi.org/10.1017/s0144686x14000610>

733 Su, F., Bell, M.G.H., 2009. Transport for older people: Characteristics and solutions. *Res.*
734 *Transp. Econ.* 25, 46–55. <https://doi.org/10.1016/j.retrec.2009.08.006>

735 Tacken, M., 1998. Mobility of the elderly in time and space in the Netherlands: An analysis
736 of the Dutch National Travel Survey. *Transportation (Amst).* 25, 379–393.

737 Tournier, I., Dommes, A., Cavallo, V., 2016. Review of safety and mobility issues among
738 older pedestrians. *Accid. Anal. Prev.* 91, 24–35.
739 <https://doi.org/http://dx.doi.org/10.1016/j.aap.2016.02.031>

740 Ward, M.R.M., Somerville, P., Bosworth, G., 2013. “Now without my car I don't know what
741 I'd do”: The transportation needs of older people in rural Lincolnshire. *Local Econ.*
742 0269094213495232.

743 World Health Organization, 2015. World report on ageing and health. World Health
744 Organization, Geneva.

745 Wretstrand, A., Svensson, H., Fristedt, S., Falkmer, T., 2009. Older people and local public
746 transit: Mobility effects of accessibility improvements in Sweden. *J. Transp. Land Use*
747 2, 49–65.

748 WS Atkins, 2001. Older People: Their Transport Needs and Requirements,
749 [http://webarchive.nationalarchives.gov.uk/20100513131223/http://www.dft.gov.uk/pgr/i](http://webarchive.nationalarchives.gov.uk/20100513131223/http://www.dft.gov.uk/pgr/inclusion/older/olderpeopletheirtransportnee3260)
750 [nclusion/older/olderpeopletheirtransportnee3260](http://webarchive.nationalarchives.gov.uk/20100513131223/http://www.dft.gov.uk/pgr/inclusion/older/olderpeopletheirtransportnee3260). Department of Transport, Local
751 Government and the Regions, London, United Kingdom.

752