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Abstract

This study proposes a conceptual framework for improving the evaluation of unmet travel needs amongst the older population. Unmet travel needs can be defined as mobility needs that remain unfulfilled due to the inability of accomplishing needed or wished trips and activities. Gerontological and transport research are putting increasing focus on the role that mobility plays in later life. Analyses of studies investigating the relationship between ageing and mobility reveal that these are generally characterised by relying only on realised journeys and activities. However, very little has been investigated so far in terms of unrealised mobility and often where it has been investigated, with different approaches and results. This article, by means of a methodological assessment of approaches used in the literature, develops a conceptual framework that can be used to investigate which mobility needs remain unfulfilled in later life. Firstly, the concept of mobility needs in later life is addressed. This concept is then used to evaluate the most appropriate method(s) to investigate factors which influence unmet travel needs. Five main domains are identified as necessary to be considered with regard to mobility during later life: transportation; health and wellbeing; built environment; type and importance of activities and demographic background characteristics. The study concludes that an inclusive approach which considers all of the domains is needed to better define the full dimension of mobility needs among the older population.

Keywords: older people; unmet travel needs; mobility needs; wellbeing; conceptual framework, methodology assessment.

1 Introduction

Gerontological and transport research are putting increasing focus on the role that mobility plays for the older population. Studies investigating the relationship between ageing and out-of-home mobility are generally characterised by being generally focused on realised journeys and activities. However, very little has been investigated so far in terms of unfulfilled mobility and often where it has been investigated, with different approaches and results. Therefore, this paper proposes a conceptual framework for improving the evaluation of unmet travel needs amongst the older population.

1.1 Mobility and wellbeing

Out-of-home mobility is considered a fundamental contributor to the wellbeing of the older population. The ability to be mobile and use transport modes has been recognised as crucial for independence and for ageing well (Farquhar, 1995; Gabriel and Bowling, 2004). It allows older people to access services and facilities they need and places and people they desire (Metz, 2000). Moreover, it provides the potential psychological and physical benefits of movement (Metz, 2000), fulfils social and leisure needs and generates a sense of being in control of one's life (Hjorthol, 2013; Knight et al., 2007; Mollenkopf et al., 2011; Musselwhite and Haddad, 2010; Nordbakke and Schwanen, 2014a). The key role played by out-of-home mobility in later life is also accentuated by expected demographic shifts towards an ageing population which is forecast for the next decades. The increase of life expectancy trends together with the decline in birth rates are producing a demographic change characterised by a steady ageing in both developed and developing countries (Lanzieri, 2011; OECD, 2001).

Several studies on mobility and wellbeing relate to the extent to which mobility needs are satisfied. Much research in this area originates from the motivational hierarchy of human

needs developed by Maslow (1968). In this theory, Maslow points out that people satisfy certain needs over others and that once basic needs related to biology and survival are met, the necessity of satisfying psychological and self-fulfilment needs emerge. A common categorisation of mobility needs that follows this approach is to classify them into utilitarian/serious and discretionary ones (Ahern and Hine, 2012; Davey, 2007; Siren et al., 2015). In this sense, utilitarian/serious needs are identified as travel necessary to achieve access to basic needs such as medical appointments and emergencies, shopping or financial services. On the other hand, discretionary needs are associated with travel related to the social, leisure and cultural realm, such as visiting other people, desired places and more generally as a means of achieving pleasure. A more elaborated hierarchy of needs based on Maslow's theory is the one proposed by Musselwhite and Haddad (2010) (Figure 1). They developed a three-tier hierarchical framework based on utilitarian, affective and aesthetic needs to define motivation for mobility and travel amongst the older population. The primary level of the framework is characterised by travelling in order to fulfil practical and utilitarian needs such as access to services and shopping facilities, medical appointments and visiting other people. Once practical needs are met, psychological needs follow. At this secondary level, older people are motivated by the need to find their identity, independence and sense of control over their life. Finally, aesthetic needs are associated with the feelings obtained by the experience of the travel itself.

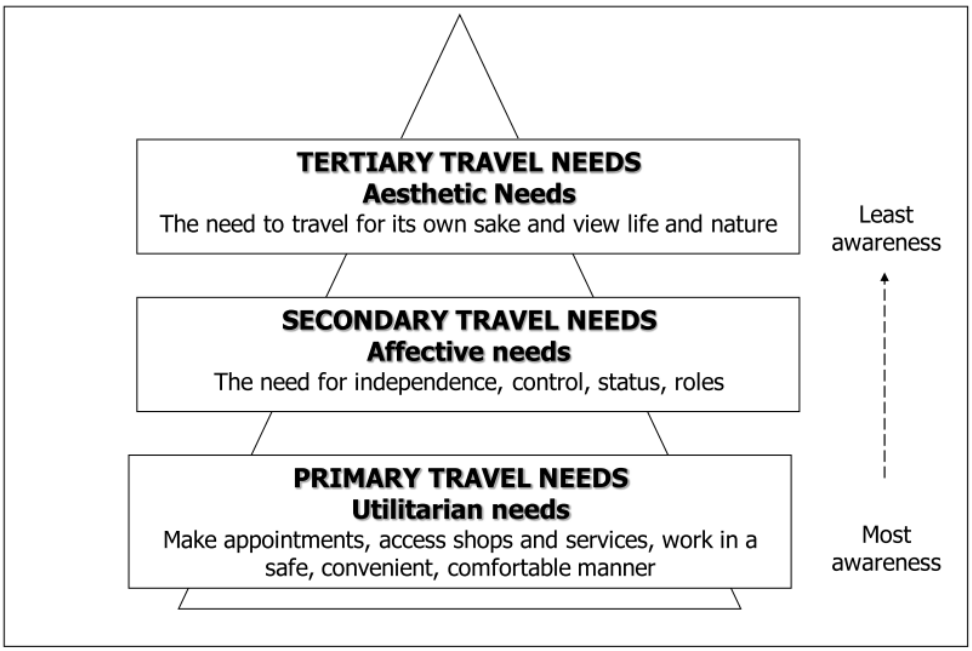

Figure 1. The three levels of mobility needs by self-awareness of the need (Musselwhite and Haddad, 2010)

Another perspective in terms of needs satisfaction, used particularly in Scandinavian research, is connected to the integral needs approach developed by Allardt (1993). This approach identifies wellbeing not only as a matter of fulfilling basic needs, but also highlights the importance of non-material aspects of life that allow individuals to flourish (Nordbakke and Schwanen, 2014a). Moreover, individuals are not considered merely as receptacles for resource inputs but play an active role in controlling and managing their resources. In this theory, wellbeing is considered in terms of needs satisfaction in the context of three different conditions of life:

- *having* - income, household, employment, health and education
- *loving* - relations with family, friends and other social relationships
- *being* - self-esteem, leisure activities, social reputation and political resources

An example of the adjustment of the integral needs approach to explain the relationship

between mobility and wellbeing of older people can be found in Hjorthol (2013) and Nordbakke and Schwanen (2014a). In their studies, journeys for shopping, health, services and commuting can be associated with the *having* aspects of life; social activities, such as trips to visit other people, and chauffeuring with *loving;* and journeys related to leisure activities with the *being* condition. However, an important element of this approach is that, contrary to Maslow's theory, activities do not belong to pre-fixed categories. Therefore, some activities can help to fulfil needs in more than one aspect of life (e.g. shopping as a primary need as well as a social or leisure need).

The active role of individuals in terms of how to manage resources is also central in the capability approach developed by Sen (1993). According to Sen, focusing only on resources is not enough to describe wellbeing, since the ability to manage resources differ according to individuals and social, temporal and spatial contexts (Nordbakke and Schwanen, 2014b). Therefore, wellbeing is identified as the freedom of choosing what type of life individuals want to live and how they use personal resources. This theory hinges upon the concepts of functionings and capabilities, where the first are the states of being and doing and the latter the combination of potential functionings that an individual can achieve. In this sense, functionings can be considered not only as achievements, but also as part of individual capabilities to relate on attaining new functionings (Nordbakke, 2013; Nordbakke and Schwanen, 2014b). Starting from this approach, Nordbakke (2013) developed a framework to assess opportunities for mobility, namely personal resources and both opportunities and barriers related to the context, during later life. More precisely, the framework is aimed at investigating active participation and choices, i.e. action strategies based on the opportunities for mobility that individuals have.

1.2 Unmet travel needs

Mobility is traditionally assessed as a derived demand by taking into account travel behaviour and preferences based on realised journeys and activities (Hjorthol, 2013). As highlighted by Siren and Hakamies-Blomqvist (2004), these approaches are often insufficient to explain mobility in later life. Low travel demand patterns do not automatically imply unfulfilled mobility (Hough et al., 2008), but at the same time, unrealised mobility might be a consequence of inadequate transport options and environment (Kim et al., 2014). Therefore, a better understanding of older people's mobility needs requires taking into account Unmet Travel Needs (UTN) in addition to those realised.

UTN can be identified as "mobility needs that remain unfulfilled due to the inability to accomplish needed or desired journeys and activities" (Luiu et al., 2017). In our previous review of the literature (Luiu et al., 2017), we investigated studies looking both directly and indirectly at the factors which affect the fulfilment of travel needs amongst the older population. These factors were analysed according to three main categories of potential barriers, namely health, transport and non-transport barriers (Figure 2).

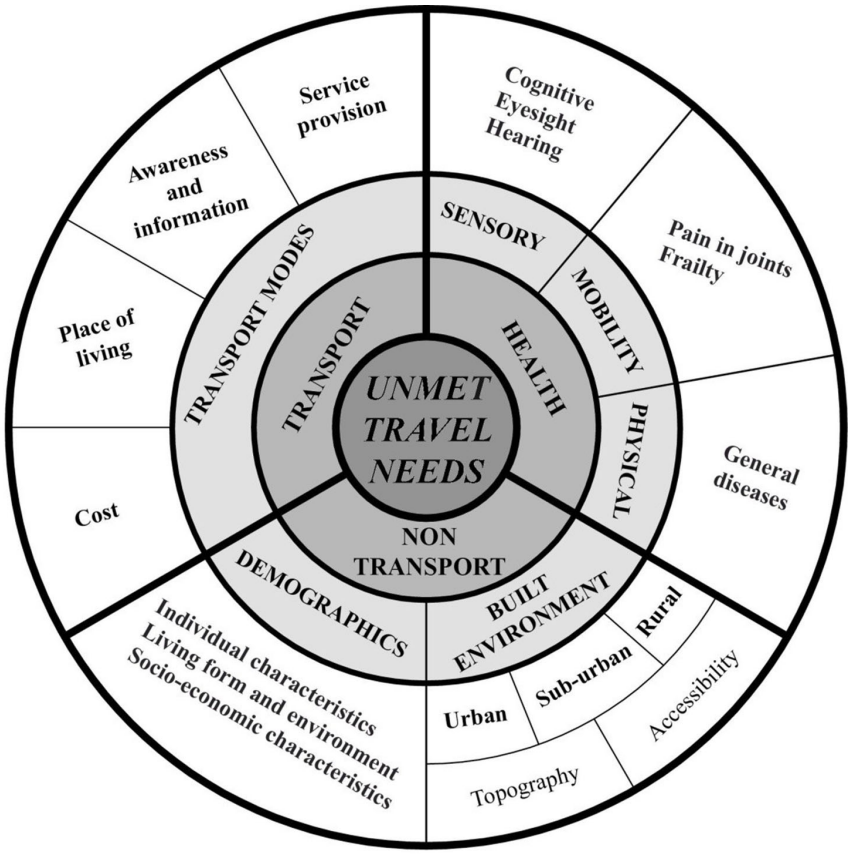

Figure 2. Conceptual framework for UTN literature review analysis (Luiu et al., 2017)

Due to the heterogeneity of older people and differences in research approaches, the analysis of the literature was found to be inconclusive in terms of identifying the real impact of the analysed variables on unrealised mobility. Nonetheless, of the studies analysed, on average at least one-third of older people reported UTN, with older women and people aged 75 years old and above the most affected groups. Leisure activities, in particular visiting friends and family, were found to be the activity most associated with UTN. Looking more specifically at the impact of barriers leading to UTN, the literature suggests that health issues seem to be the ones that most significantly affect travel needs among older people, by reducing the range of activities undertaken and creating problems with use of transport modes, particularly boarding operations. Non-transport barriers were characterised by ambiguity in findings, especially for the impact of the built environment and marital status, among the socio-

demographic background variables. However, the most relevant finding is the contrast between studies that found access to a car is necessary to fulfil mobility needs in later life and those that did not. Despite the majority of the reviewed studies stating the importance of holding a driving license and having access to cars, two studies (Kasper and Scheiner, 2002; Scheiner, 2006) showed these to be statistically insignificant when other variables are controlled for. Nordbakke (2013) recognised the importance of having access to a car for particular situations. Nonetheless, she highlighted that out-of-home mobility relies on more than being able to drive or having access to the car and that limiting the focus on these issues is insufficient to understand factors influencing mobility in later life, due to the variety of determinants that interact with and affect it.

1.3 Aim of the study

This study builds on and continues our work on UTN of older people described in Luiu et al. (2017) with the aim of addressing some of the gaps in the literature and developing a conceptual framework designed to help the investigation of which mobility needs remain unfulfilled during later life. Starting from the insights related to the concepts of mobility needs highlighted above and the approaches used in the studies identified in Section 3 of this paper, a methodology assessment has been used to develop the framework in order to evaluate the best approach for identifying and assessing factors and barriers leading to UTN.

2 Methodology

Taking into consideration the significance of the relationship between out-of-home mobility and wellbeing highlighted in Section 1, in this study mobility is not considered only as a derived demand, but as a more comprehensive concept in relation to wellbeing and needs satisfaction. Therefore, mobility is identified as the set of potential benefits proposed by Metz

(2000), namely the ability to gain access to desired places or to meet with people; the physiological and psychological benefits of movement related to getting out and about; benefits from involvement in social and local community and the benefits from travel itself.

The development of the proposed conceptual framework is delineated by three different stages, as shown in Figure 3.

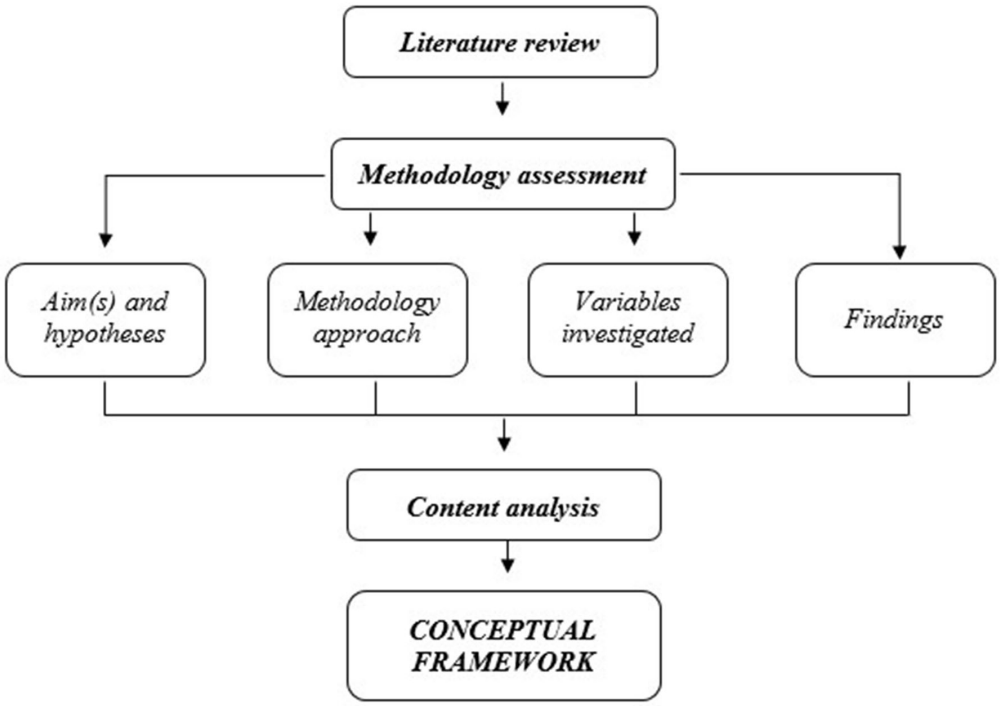

Figure 3. Methodology stages

The first stage consisted of mapping studies on UTN during later life. In this sense, we used the set of studies identified by Luiu et al. (2017), but considered only those studies directly addressing factors affecting UTN. Then, a methodology assessment was used to analyse firstly the aim(s) and hypotheses behind each study, then the approaches, variables used and finally findings from each study. Lastly, a content analysis was undertaken to categorise the information from the previous stages and identify themes that influence mobility in later life.

3 Analytic approach

Out of the twenty-nine studies found in Luiu et al. (2017), fourteen have been identified as addressing UTN in a direct way. An additional study (Musselwhite, 2017) published subsequently to the review has also been taken into account due to its characteristics. An overview of the identified studies, their sampling strategies, data collection and analysis approaches, and geographical context is provided in Table 1.

Table 1. Overview of selected studies

Author(s)	*Year*	*Age group*	*Sample and data collection approach*	*Analysis method(s)*	*Study location*
WS Atkins	2000	60+	1445 face-to-face interviews and 6 focus group with 7-10 respondents	Content analysis	England and Wales
Kasper and Scheiner	2002	60+	1911 questionnaire respondents	Cross-tabulation	Germany
Siren and Hakamies-Blomqvist	2004	65+	1522 questionnaire respondents	ANOVA test Cross-tabulation	Finland
Scheiner	2006	60+	4500 interview respondents	Logistic regression	Germany
Davey	2007	60+	99 face-to-face semi-structured interview respondents	Cross-tabulation Content analysis	New Zealand
Musselwhite and Haddad	2010	65+	26 individuals in 3 focus groups and telephone interviews plus 31 telephone interview respondents	Content analysis	England
Kim	2011	65+	603 telephone interview respondents	Z-test Logistic regression	U.S.A.
Wasfi et al.	2012	55+	854 questionnaires plus 775 travel diaries respondents	Cross-tabulation	U.S.A.

Table 1. Overview of selected studies (Continued)

Author(s)	*Year*	*Age group*	*Sample and data collection approach*	*Analysis approach*	*Study location*
Hjorthol	2013	67+	1889 questionnaires respondents	Cross-tabulation Logistic regression	Norway
Nordbakke	2013	67+	4 focus groups with 31 female respondents	Content analysis	Norway
Haustein and Siren	2014	70+	1508 telephone interviews plus 1161 telephone interview respondents	Cross-tabulation ANOVA test Chi-squared test K-W H-test Ordinal regression	Denmark
Nordbakke and Schwanen	2014	67+	4723 questionnaires respondents	Cross-tabulation Chi-squared test Ordinal regression	Norway
Siren and Haustein	2014	70+	1792 telephone interview respondents plus 863 telephone interview respondents	Cross-tabulation Chi-squared test Linear regression U-test T-test	Denmark
Kim et al.	2014	65+	812 questionnaire respondents	Cross-tabulation Logistic regression Principal component analysis	The Republic of Korea
Musselwhite	2017	63+	60 semi-structured interview respondents	Content analysis	Wales

Looking at the aims and findings of the identified studies, it is possible to state that the main focus to date has been to understand the impact of car access during later life. Musselwhite and Haddad (2010) investigated the effect of driving cessation in fulfilling travel needs by comparing older drivers and ex-drivers. They found that people who had stopped driving reported more unmet travel needs compared to drivers, particularly for social and spontaneous trips which were very difficult without car access. Siren and Haustein (2014) looked at the effect of not renewing a driving licence with regard to mobility patterns, unfulfilled mobility needs and physical and psychological wellbeing. Again, older people not renewing their driving licence were found to report more unmet travel needs. Health conditions and physical and mental wellbeing were also found to be factors affecting mobility fulfilment. Leisure activities, such as visiting family and friends, pursuing hobbies and spontaneous trips, were the ones participants report missing the most. Haustein and Siren (2014) analysed the impact of car access on older drivers, former drivers and people who never drove. Their study shows that lack of having a driving licence and health impairments increase the chance of experiencing unmet travel needs, particularly visiting other people. Former drivers and people who had never driven presented similar patterns, but the latter reported more unfulfilled needs, particularly for shopping activities. Davey (2007) identified experiences and preferences of former drivers with respect to how they meet their mobility needs. Access to the car was found to be significant in terms of reducing unmet travel needs and the car remains the preferred option either as a passenger or driver, since lifts were reported by almost two-thirds of participants as their first option after driving cessation (especially women). Moreover, car unavailability was found to reduce spontaneous trips and the ability to attend special occasions, due to lack of alternatives for these types of activities. Musselwhite (2017) examined fulfilment of discretionary activities amongst drivers, community transport users and older people who do not drive and rely on lifts from others for

their travel. Discretionary travel was found to be associated with positive health and wellbeing status. Cars were identified as the best way to meet these travel needs, especially for older drivers. Older people relying on lifts reported feelings of strain due to the burden they place on others, while community transport was associated with loss of control and spontaneity, despite meeting their travel needs. Likewise, Scheiner (2006) investigated how car availability and settlement structure have impacts on leisure activities. Contrary to other studies, he found that car access was not found statistically significantly related to unfulfilled activity when health impairments, employment status and gender were taken into account. Both Kim (2011) and Kim et al. (2014) analysed the effect of not being able to undertake desired out-of-home activities due to a lack of transportation (transport deficiency). Kim (2011) found that women, people living alone or in households with one or more children and older people with no driving licence reported more transport deficiencies. Moreover, good health and positive wellbeing reduced these effects. Kim et al. (2014) found that those with health impairments and people who stopped driving (particularly men) report more transport deficiencies, while living in the same community for a long time or in flatter areas both reduce unrealised mobility.

Nordbakke (2013) investigated how individual resources and contextual options can influence opportunities for mobility using Sen's capability approach to wellbeing (Sen, 1993). Her findings highlight that an individual's resources in terms of knowledge of a transport system, competence in using it, and control of travel time can reduce unmet travel needs. The time of activity and the geographical location of public transport were also found to affect mobility needs. Siren and Hakamies-Blomqvist (2004) examined mobility options and resources in terms of both travel behaviour and unfulfilled travel needs. Their study showed that women and people aged 75 years old and above were the ones reporting more unfulfilled travel needs, especially leisure-related ones. Moreover, holding a driving licence

and living in an urban context reduced the level of unfulfilled travel needs. Similarly, Wasfi et al. (2012) assessed the relationship between travel demand and activities in terms of both fulfilled and unfulfilled mobility. Car access, walking distance and distance from bus stops from both origin and destinations were found to affect unmet travel needs. The car access effect was found to be particularly strong in suburban areas due to lack of alternatives. Medical, shopping and social/recreational activities were the ones participants report missing the most. WS Atkins (2001) examined transport needs and requirements during later life. Unmet travel needs were related to a general lack of available transport to specific destinations, cost and difficulties in walking and in using public transport. Leisure activities and social aspects of travel were reported the most, especially in a rural context. Kasper and Scheiner (2002) investigated mobility barriers leading to unfulfilled activity wishes. Health impairments were found to be the main factor affecting desired activities, while people holding a driving licence and having a car available in the household report more unmet activities. Leisure activities, especially cultural, were the ones most reported.

Hjorthol (2013) and Nordbakke and Schwanen (2014a) investigated the relationship between transport and wellbeing in terms of travel needs satisfaction. They found that health impairments, not holding a driving license and having no access to a car were factors which negatively affected unmet travel needs. Visiting friends and family and going out for a walk were the type of activities participants report missing the most. Similar results were found in the Nordbakke and Schwanen (2014a) study, particularly due to lack of available time, poor health, living with a partner, lack of social support and overall low life satisfaction.

1 Table 2. Assessment of variables investigated from selected studies

Framework domain	Variables investigated	WS Atkins (2001)	Kasper & Scheiner (2002)	Siren & Hakamies-Blomqvist (2004)	Scheiner (2006)	Davey (2007)	Musselwhite & Haddad (2010)	Kim (2011)	Wasfi et al. (2012)	Hjorthol (2013)	Nordbakke (2013)	Kim et al (2014)	Norbakke & Schwanen (2014)	Haustein & Siren (2014)	Siren & Haustein (2014)	Musselwhite (2017)
Transportation	Transport mode used for activities	○	○			○	○				○	○			○	○
	Mode choice	○		○		○										
	Transport dependency on other					●		○	●	○				○	○	○
	Driving licence status		○	●	○	○	●	●		●		○	●	●	●	
	Trip frequency by purpose		○	○					○			○				
	Travel time										○					
	Trip cost	●										○				
	Transport authonomy/familiarity per mode						○	○	○					○		
	Transport perception per mode	○												○		○
	Transport knowledge							○			●	●				
	Transport planning										○					
	Access to transport resources	●	●	○					●	○	●			●		●
	Car access	○	○	○		●	●	●	●	●						●
	Coping without a car					○	○			○						○
	Transport satisfaction		○			○										
	PT season ticket	○			○											
Health and wellbeing	Self-perceived status - satisfaction									●				●		
	Self-perceived status - conditions	●	●		●	●		●							●	○
	Type of syntomps/impairments												●	●	●	
	Impairments affecting walkings	●			○	●			○				●	○		
	Impairments affecting driving														○	
	Level of mobility	○										●				
	CES-D depression scale test													○	●	
	Pearlin mastery scale test													○	●	
	Self-perceived general life satisfaction							●		○			●			
	Latent factors											○				
Built environment	Distance to PT										○	●	○			
	Residential location	○	○	●	○			●	○	●			○	●		
	Topography										●	●				
	Design/elements of furniture											○				
	Park within walking distance											○				
	Places to meet other people at walking distance											●				
	Built environment of activity										●					
	Access to facilities		●		○			●			●					
	Satisfaction				○											
Activities	Activity frequency/participation	○	○		○	○							○	○	○	
	Reasons for not undertaking activities		○										●			
	Need help with activies										○		○			
	Type of activities	●	○	○							○		○			
	Transport deficiency										○					
	Time/duration		○								●					
	Importance of activity								○							○
	Activity diversity				○											
Demographics	Gender	○		○	●	○		●	○	○		●	○	○	○	
	Age	○	●	○	○	○		○	○	●	○	●	○			○
	Education	○		○	○			○	○	○				○	○	
	Income				○	○		○	○	○		●	○	○		
	Employment status				●							○				
	Living status		○		○			●				●	●	●	●	○
	Social network		●			○		○			○		○			●
	Household characteristics							○	○			●				
	Years lived in local community					○		○				●				
	Ethnicity	○				○		●	○							

● *Variable found to have effect on UTN*

○ *Variable found to have no effect on UTN*

2

Finally, the content analysis of the methodology assessment related to the selected empirical studies identifies five main domains that shape and influence mobility in later life, namely: 1) Transportation; 2) Health and wellbeing; 3) Built environment, 4) Demographics and 5) Activities. Table 2 illustrates the five domains and outlines the variables found during their assessment. The variables are differentiated by whether they were shown to have an effect on UTN. The five domains building the framework and their components are described in the following section.

4 The conceptual framework

4.1 Transportation

Taking into account the approach used by Nordbakke (2013) with regard to the concept of opportunities for mobility, the Transportation domain is used to evaluate the individual resources and abilities required for everyday mobility. This is done by investigating four main aspects: travel patterns and access to transport modes, attitudes towards transportation, coping strategies and planning.

As it was pointed out in the introduction of this paper, in order to understand mobility needs in later life, both realised and unrealised mobility need to be taken into account. Traditionally, travel patterns are analysed in terms of activity frequency and the most common mode of transport used for each activity. In this sense it is crucial not only to understand how and why older people move, but also how easy it is to access transport options. Access to the car and holding a driving licence have been considered to play a significant role in later life mobility, since it provides autonomy, flexibility, independence, freedom and control (Davey, 2007; Glasgow and Blakely, 2000; Siren, 2005). Nonetheless, not all older people have access to car in their household or hold a driving licence, in part due to health and psychological issues associated with ageing (Adler and Rottunda, 2006;

Hakamies-Blomqvist and Peters, 2000). Therefore, investigating access to alternative transport options to the car, such as public transport, flexible transport services (e.g. community transport and dial-a-ride services), walking and cycling is fundamental. This is valid not only in terms of access to services and infrastructures, but also to reach other potential destinations. Moreover, another significant aspect to take into account is related to specifically designed travel schemes for older people. Indeed, one of the main criticisms of Scheiner (2006) was that older people with a public transport season ticket reported similar levels of activity fulfilment compared to older drivers.

Access to transportation resources is only a part of this process, since understanding the attitude individuals have towards these resources is also important. In their study, Haustein and Siren (2014) measured attitudes towards transportation by analysing autonomy and abilities to use a specific transport mode, in addition to enjoyment and other positive aspects associated with its use. Similarly, Wasfi et al. (2012) analysed how familiar older people were with alternative options to the car and how independent they were in terms of mobility. In this sense, another significant aspect of transport autonomy is understanding the experiences and coping strategies used by those older people who do not drive. This is significant to understanding dependency on others in terms of both knowledge/information and practical transportation. Several studies on driving cessation found that car remains the preferred option once people have stopped driving, through reliance on lifts from family or friends, but with consequences in terms of lack of spontaneity and burden placed on the drivers (Davey, 2007; Glasgow and Blakely, 2000; Musselwhite, 2017; Taylor and Tripodes, 2001). Finally, the framework puts attention on the planning activity behind a trip in order to assess the extent of knowledge and preparation that older people have for their journeys.

4.2 Health and wellbeing

The second domain identified for the framework relates to existing health conditions and individuals' wellbeing. Luiu et al. (2017) showed health was the most significant barrier leading to UTN during later life. The most common approach used by the studies mentioned in Section 3 of the paper is to analyse health conditions from a subjective point of view. Much research in this sense relies on self-assessment using rating scales based on satisfaction or general conditions (e.g. poor/excellent). In addition to subjective judgements, both Haustein and Siren (2014) and Siren and Haustein (2014) adopted a more objective approach to measure health conditions by asking participants to report symptoms, illnesses or impairments from a list. In this study health is analysed according to cognitive, sensory and physical impairment, following the approach used by Tournier et al. (2016) to assess health barriers affecting older pedestrians. The aim of the framework is not only to assess if a health impairment does or doesn't lead to UTN, but rather trying to identify the relationship between type of impairment and difficulty in using transportation options or undertaking specific activities.

The other aspect of this domain involves assessing individuals' wellbeing, since it is important not only to focus on health and functional status (Gabriel and Bowling, 2004), but also understanding life satisfaction in relation to different aspects of everyday life and their perception. As with the health domain, few studies have analysed individuals' wellbeing using a self-perceived status assessment based on general life satisfaction (Hjorthol, 2013; Nordbakke and Schwanen, 2014b). In addition to this measure, Davey (2007) explored individuals' satisfaction regarding both place of residence and transportation. Looking at a more detailed evaluation of individual's psychological aspects and opinions, Kim et al. (2014) undertook an in-depth investigation of the impact of QoL by assessing latent factors

related to everyday life. Using a subjective approach based on an agreement Likert scale (strongly agree/strongly disagree), they explored individual points of view regarding (i) Activity propensity; (ii) Symbolic motive of automobile; (iii) Community spirit; (iv) Obey traffic regulation; (v) Environment; (vi) Dissatisfaction about public transit; (vii) Sensitivity to pollution; (viii) Parsimonious propensity; (ix) Competitive spirit; (x) Respect others' opinion; and (xi) Health and Independence. Finally, in order to assess the extent to which individuals see themselves in control of their lives, both Haustein and Siren (2014) and Siren and Haustein (2014) adopted a more objective approach to measure individual's QoL by using the CES-D depression scale and the Pearlin mastery scale (Pearlin and Schooler, 1978).

4.3 Built environment

Contrary to the findings for health, the effect of the built environment on UTN was shown in Luiu et al. (2017) to be more ambiguous. This was likely mainly due to differences of settlement structures between countries, with consequent difficulties in comparative assessment. As shown in Table 2, much research analysed the built environment by categorising an individual's place of residence, usually as urban, suburban or rural. However, what defines these three categories might differ from country to country, with consequent issues in terms of comparison. Therefore, a more defined range of spatial characteristics should be applied when investigating the spatial structure of settlements, as highlighted by Scheiner (2006). In his study, settlements were further classified in inner city quarters, highly urbanised former villages, satellite towns with good/less developed public transport (urban); central places in suburbia, settlements with/without sufficient provision of supply in suburbia (suburban), central places in the rural area and other rural places (rural).

The second and fundamental aspect of the analysis relates to understanding the relationship between mobility and built environment in terms of access to transport resources, service

facilities and goods. Distance to the closest public transport stop was a factor analysed in several studies (Kim et al., 2014; Nordbakke, 2013; Nordbakke and Schwanen, 2014a). This is likely due to the fact that density and location of bus/tram stops or train station from both home and destination might require a physical effort that could deter or prevent older people from using public transport (Broome et al., 2010; Davey, 2007; Su and Bell, 2009; Wretstrand et al., 2009). Moreover, the form of the built environment, often designed for vehicles rather than human mobility, can create a barrier to walking and cycling activities, due to the development of phenomena such as community severance or the lack of adequate infrastructures (Mindell et al., 2011; Rosenbloom, 2009; Ryan et al., 2016). The topography of the built environment can also hinder travel needs if hills and slopes are present, particularly to reach public transport stops or other places to visit within walking distance (Kim et al., 2014). In a similar way, lack of access to service facilities and goods might create UTN. More specifically, Kim et al. (2014) looked at presence of parks or places to meet other people within walking distance (e.g. senior or community centres). Nordbakke (2013) found that the quality of the built environment in terms of accessibility, as well as the presence or parking facilities, could be a factor affecting mobility. Finally, Scheiner (2006) concluded that a specific spatially differentiated analysis based on type of activities could produce a more detailed spatial effect, since, for example, cultural or leisure activities might be more common in an urban environment compared to the rural one.

4.4 Activities

In the activity domain, the framework focuses on two main aspects. First, the type of activity and the extent of engagement with activities that older people have. Nordbakke and Schwanen (2014a) pointed out how actual activity participation has been scarcely measured in studies investigating UTN in later life. In their view, an inverse relationship between

activity participation and unfulfilled mobility might be expected, especially if taking into account the approach used by Allardt (1993). They assessed activity participation using a scale from never to almost every day. A similar approach was used also by Siren and Haustein (2014), Haustein and Siren (2014), Siren and Hakamies-Blomqvist (2004) and Kasper and Scheiner (2002). In addition to activity frequency, Scheiner (2006) highlighted the importance of analysing activity diversity.

The second aspect is related to the importance that activities have and how these are perceived by the older population. The majority of the studies assessing unrealised mobility use a classification of needs satisfaction to assess the importance of an activity. However, as mentioned before, the hierarchical classification of utilitarian and discretionary related to the concept of basic needs satisfaction does not consider the possibility of meeting travel needs along different dimensions, as is the case in Allardt's (1993) approach. Nonetheless, the reliance on these types of classification does not show how effectively activities are perceived, since the difference between what is needed or desired rarely comes to light using this approach. In their study, Wasfi et al. (2012) specifically differentiate between the types of activities older people need and wish to do more.

4.5 Demographics

The last of the five identified domains is the one associated with individuals' background demographic characteristics. The older population is characterised by being significantly heterogeneous in terms of demographic characteristics. Luiu et al. (2017) showed that the effect of demographic variables varied among the investigated studies, most likely due to differences in sampling and context. Nonetheless, analysis of this information is necessary to assess the complexity and importance of demographic characteristics. To identify the

demographic variables needed for the framework, this study draws on the standards used by previous studies of this type. The selected variables are presented according to individual characteristics, socio-economic factors, living form and environment and social network (Haustein and Siren, 2015).

Individual characteristics and socio-economics factors were found to have no significant effect on UTN by Luiu et al. (2017) and can be considered as a weak predictor of mobility, given the fact that they are significantly influenced by other things (e.g. health conditions for age or access to the car for gender) (Haustein and Siren, 2015). Individual characteristics include age, gender and ethnicity. With regard to age, the framework focusses on the chronological aspect of age. Much research has shown that travel tends to decrease with age (Haustein et al., 2013), and that people aged 75+ years old report more UTN compared to the youngest group of older people (Luiu et al., 2017). Gender characteristics also present some differences, since women tend to report a greater desire to travel more, have lower car access, give up driving earlier and use alternative transport options more than men (Haustein et al., 2013). Ethnicity does not seem to be a relevant predictor of mobility in later life, but this may be due to little research in this area. However, as underlined by Haustein et al. (2013), our society is not only influenced by demographic trends related to the ageing of the population, but also through immigration and diversity.

Socio-economic factors are identified as personal or household income, education and employment status. Low income during later life has been found to be associated with constraints of both modal choice and travel frequency due to cost issues as well as the ability to run a car (Knight et al., 2007; Su and Bell, 2009; WS Atkins, 2001). Scheiner (2006) found employment status to have an impact on unfulfilled mobility, probably due to the limited amount of free time available to carry out desired activities. The vast majority of the older

population is retired, and consequently they have greater possibility to adjust their schedules according to their needs due to more free time available (Su and Bell, 2009). Nonetheless, the demographic changes mentioned above might have an impact on delaying retirement age in the near future, with consequent potential impacts in terms of mobility fulfilment.

Living form and built environment characteristics include marital status, number of people living in the household, number of dependent people and amount of years living in the local community. These variables were shown to be quite controversial in Luiu et al. (2017). On the one hand living with a partner reduced the chances of unfulfilled mobility, especially for social and leisure reasons (Haustein and Siren, 2014; Kim et al., 2014; Musselwhite and Haddad, 2010; Nordbakke and Schwanen, 2014a). On the other hand, living with a partner or other people could also lead to UTN, if these are dependent people (Knight et al., 2007; Scheiner, 2006) or when living with children under 18 years, due to caring duties (Kim et al., 2014; Kim, 2011). The investigation of the amount of years lived in the local community used by Davey (2007), Kim (2011) and Kim et al. (2014) could reveal important information to understand if living in the same place for an extended amount of time increases the knowledge of potential transport options available and at the same time the individual social network, with consequent opportunities to reduce UTN.

The last group of demographic information relates to the social network of an individual. More specifically, the framework proposes to analyse the extent to which people are regularly in contact with the older person. Davey (2007) investigated both participants visit frequency and how much family, friends and neighbours visited. Similarly, Scheiner (2006) explored the extent of the level of social networks using a rating scale (dense/weak). Social networks during later life seems to have a significant role for two reasons. It can be very important to support mobility of older people with mobility restrictions, such as no driving licence or no

access to car in the household (Davey, 2007; Musselwhite and Haddad, 2010), whilst at the same time encouraging people to undertake out-of-home activities (Kasper and Scheiner, 2002; Nordbakke, 2013; Nordbakke and Schwanen, 2014a). With regard to the former, Nordbakke and Schwanen (2014b) differentiated the help needed with transportation between grocery shopping and other purposes. About the latter, both Kasper and Scheiner (2002) and Nordbakke and Schwanen (2014a) analysed the impact of undertaking out-of-home activities alone or with other people.

5 Discussion and conclusions

In the context of an increasing interest in the mobility needs of the older population, this paper proposes a conceptual framework for improving the evaluation of UTN during later life. Existing analyses which investigate only realised journeys and activities are insufficient to provide a complete picture of older people's mobility in terms of needs fulfilment, it is also necessary to take into account unrealised mobility. The proposed framework strives to address this by identifying which factors need to be taken into account when exploring the unrealised mobility of the older population and uses a combination of qualitative and quantitative variables as a means to analyse UTN.

Overall, the main emphasis of existing studies on UTN has been on understanding the impact of access to the car to fulfil mobility needs. In spite of the impacts that driving or using a car can have, the theoretical premise of our conceptual framework is that mobility in later life needs consideration of much more than just the transport environment and options available. In this sense, as shown by Luiu et al. (2017) and illustrated in Table 2, some variables are more significant than others in terms of having an effect on UTN, namely: health impairments, holding a driving licence, having access to a car and living status. Nonetheless, due to the variety of approaches and foci, there is still ambiguity in the literature on the real

impact on the variables investigated. Therefore, this framework does not build on a specific theoretical concept, but rather on an intensive review and assessment of the aims and variables investigated to date about UTN in later life. The framework is a construct of five interrelated domains that shape and influence mobility in later life. As illustrated in Figure 4, the five domains have been disaggregated into sixteen sub-themes, which are addressed by at least one of the identified studies addressing UTN amongst the older population. It is important to highlight that individual studies might differ from a more theoretical approach according to their purpose, sample and context of investigation, which may lead to some bias in the choice of variables for inclusion. Hence, the conceptual framework outlined here does not set out a precise protocol to follow, but rather highlights the factors and variables which need to be taken into account when addressing UTN in later life.

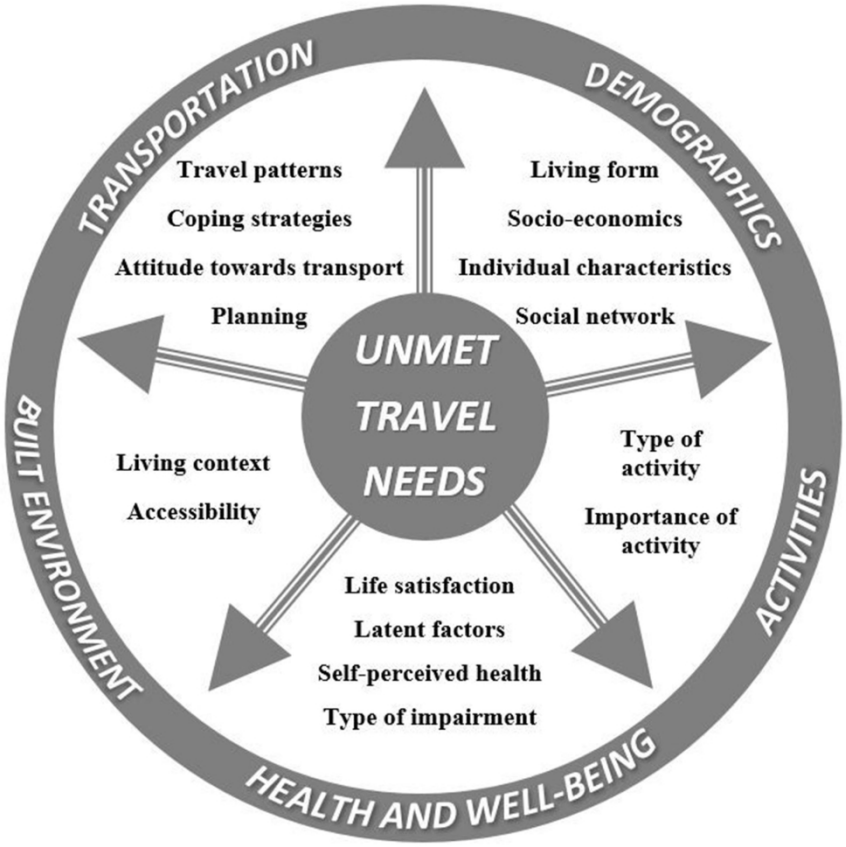

Figure 4. Conceptual framework to assess unmet travel needs in later life

The paper contributes to the research on older people's mobility in three main ways. Firstly, it presents an overview of a different conceptualisation of mobility needs approaches. Secondly, it provides a methodological assessment of studies investigating the issue of UTN. Finally, it defines which are the components that shape and influence mobility in later life. The framework has the potential to contribute to a better understanding regarding mobility fulfilment amongst older people. Future research can employ this framework in order to further investigate the insights generated on unrealised mobility. These insights can be used to help the development of more targeted interventions regarding age-friendly transport and environments and, more generally, the linkage between mobility and wellbeing in later life.

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