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Transport, unmet activity needs and wellbeing in later life: exploring the links

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Abstract Using nationally representative data from Norway, this paper analyses the link between transport and wellbeing by considering the extent to which older adults believe that their needs for out-of-home activity participation remain unsatisfied. It demonstrates that such transport-related factors as holding a driving license and subjective evaluations of public transport supply shape the level of unmet needs for out-of-home activity. Other factors that help explain differences in the extent of unmet activity needs include actual participation in out-of-home activities, self-perceived health and problems with walking, outlook on life, residential location and indicators of social support and social networks. It is concluded that policymakers seeking to raise wellbeing above a minimum threshold of what counts as a decent life should enhance older adults' ability to drive in old age and car availability, lower the distance to public transport stops, and improve the connectivity that public transport offers to destinations. Policies to improve wellbeing in later life should nonetheless move beyond silo thinking. Questions of mobility in later life require a cross-sector and holistic approach to policy that transcends the realm of transport planning.

Keywords Ageing · Wellbeing · Need · Norway

Introduction

Across the Western world the population is ageing. According to Eurostat (2013), those aged 65+ will account for 29.5 % of the EU's population by 2060 compared to 17.5 % in

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2011, whilst the share of those aged 80+ will almost triple between 2011 and 2060. Although the older population is healthier than ever, ageing often implies reduced functional capacities and hence reduced capacity for mobility—here defined as actual physical movement through space—for individuals. As mobility is imperative to independent living and the ability to meet relatives, friends and other social ties, reduced capacity for mobility is likely to adversely affect wellbeing in later life (Schwanen et al. 2012).

The academic literature on the links between mobility and wellbeing in later life is growing rapidly (Nordbakke and Schwanen 2014). In this work wellbeing tends to be understood primarily in terms of life satisfaction, happiness or preference satisfaction (Ieda and Muraki 1999; Spinney et al. 2009; Mollenkopf et al. 2011), and as (mental) health (Marottoli et al. 1997; Ragland et al. 2005; Windsor et al. 2007). Whilst those understandings are very insightful, we emphasise the importance of considering wellbeing also in terms of the fulfilment of needs (Bowling 2005; Phillips 2006) as this is constitutive of human flourishing (Ryff 1989; Sen 1993; Waterman 1993). A needs approach to wellbeing also allows policy makers to consider whether the extent of unmet needs exceeds thresholds of acceptability. Needs-oriented research can inform policy interventions that seek to ensure that, for instance via improved transport options, a minimum level of needs is fulfilled among older adults.

At least three past studies of mobility in later life have understood wellbeing in terms of need fulfilment and that have explored the factors associated with needs fulfilment (Kim 2011; Scheiner 2006; Siren and Hakamies-Blomqvist 2004). Siren and Hakamies-Blomqvist (2004) analyse how the level of unfulfilled *travel* needs (differentiated according to ten trip purposes) among men and women aged 65 + in Finland varies according to age, gender, education, driving license, and residential location. Their headline finding is that, when gender, age and educational level are controlled, unfulfilled travel needs are greater among older adults without a driving license or living in a rural setting.

In contrast, Scheiner (2006) explores unfulfilled *leisure activity* needs and Kim (2011) unfulfilled *activity* needs *in general* among older people in Germany (aged 60+) and the USA (aged 65+), respectively. Both authors consider a wider range of variables to explain differences in needs fulfilment than do Siren and Hakamies-Blomqvist (2004). Scheiner (2006) finds that poor health is one of the main predictors of unfulfilled leisure activity needs but detects no effect of holding a driving license when controlling for health and other factors. Whilst also finding a health effect, Kim (2011) further shows that older adults with lower availability of a personal vehicle are more likely to experience unfulfilled activity needs. The differences between these studies regarding the importance of car availability and owning a driving license might relate to the greater distances to destinations and poorer supply of public transport in the USA, rendering people in that country more car-dependent than their European counterparts. This conjecture is reinforced by earlier research showing that older people in the USA rely on the car for 90 % of their transport (Collia et al. 2003).

The current paper extends the work by Siren and Hakamies-Blomqvist (2004), Scheiner (2006) and Kim (2011). It examines the relationships between transport and wellbeing by statistically explaining the extent of unmet needs for out-of-home activity. The degree to which the needs engaging in daily out-of-home activities can satisfy remain unfulfilled is derived from responses to a survey question asking older people whether they would have liked to participate in a range of daily out-of-home activities more often. Following the aforementioned studies, we explore to what extent unmet needs for out-of-home activity are a function of such factors as car availability and use, self-perceived health, socio-

demographics (gender, age, living situation), socio-economic status (income), residential location, and support from one's social network. Yet, we extend earlier work in two ways. Compared to Scheiner (2006) and Kim (2011), we do not analyse whether needs are satisfied or not in a dichotomous fashion but consider different degrees to which needs for out-of-home activity remain unmet. Additionally, we take a wider range of factors into account to explain differentiation in unmet needs. Thus we consider, amongst others, indicators of actual activity participation and outlook on life, as well as more refined indicators than in previous studies of the availability of public transport and monetary resources for transport.

Theoretical background

Needs and mobility

Much research on needs and wellbeing draws on Maslow's hierarchy of needs (Maslow 1968) and his argument that emotional and social needs become more prominent once basic biological and survival needs are met. Basic needs approaches to wellbeing focus on those biological and survival needs; they define wellbeing as the entitlement to a minimally decent life and in terms of minimum thresholds for a decent life (Phillips 2006; Nordbakke and Schwanen 2014). Therefore, the emphasis is on access to food, water, shelter, medical services and education, as well as on externalities that might adversely affect these needs (such as pollution which might affect health and life expectancy). Because basic needs approaches do not capture all elements that contribute to human flourishing, this study employs the needs approach to wellbeing that was developed by the Finnish sociologist Eric Allardt. To Allardt (1975; 1993) wellbeing amounts to the fulfillment of needs along three dimensions:

- *To have*: the material level of living (welfare) and need for material resources (i.e. work, education, money);
- *To love*: the non-material aspects of life and more specifically the need for social relations, such as friendship and family ties; and
- *To be*: the need for self-realization and positive judgment of oneself (which might be fulfilled through e.g. education, work and friendships).

According to Allardt (1975, p. 47), individuals have to function as actors in different activity arenas, such as the economic market for goods and services, the labour market, the neighbourhood, family life, the leisure sphere and the political arena. The term 'activity arena' is here understood as a sphere of life where individuals participate in activities in order to function in society and satisfy needs. Individuals can use their resources in different activity arenas and so fulfil their needs to 'have', to 'love' and to 'be'.

The satisfaction of needs along one dimension often functions as a resource for the satisfaction of other needs along the same dimension or along other dimensions. Hence, the satisfaction of needs along these dimensions can be understood as both result and resource. For example, education can both satisfy the need to be (as it contributes to self-realization) and function as a resource in obtaining employment, which in turn can fulfil the need *to have* (e.g. income) and in many cases also the need to be (e.g. self-realization through work).

Although Allardt acknowledges that needs are socially defined and can change, he also argues that in most societies and social groups there exists a modicum of agreement in

respect to what the most important needs are. His framework is less successful in explaining why some activities are more important to some people and less important than others. This is where the Maslow-oriented work by Tonn in the early 1980s is useful. Tonn (1984a, b) suggests individuals prioritise activity participation and time allocation on the basis of their distinct beliefs about which activities are most instrumental in satisfying particular needs at a specific moment in time. As beliefs about the relationship between activities and needs differ between individuals and can also change over a person's life-course, Tonn's framework also helps to explain why some individuals experience unfulfilled activity needs and other do not, even when their out-of-home activity participation and time use are identical.

The chief assumption in this paper is that out-of-home activities can contribute to the fulfillment of the needs along the dimensions to have, to love and to be. On the one hand, it is tempting to think of certain activities as primarily fulfilling needs along a specific dimension. Shopping trips, running errands, trips to see a healthcare professional and commuting would then be seen as satisfying needs along the *having* dimension; trips for social visits and chauffeuring as related to *loving*; and trips to access different types of leisure activities as deriving from needs along the dimension of *being*. On the other, however, activities can—and often do—fulfil needs along several dimensions. For instance, in a focus group study among older people aged 67+ in two Norwegian cities (Hjorthol and Nordbakke 2008), several participants stated that grocery shopping was not only important for obtaining food items but also offered an opportunity to socialise (e.g. to chat with the employees in the grocery store and to meet acquaintances and friends). Hence, to some older people grocery shopping is both an instrumental and a social activity. Particularly when a quantitative methodology is used, it is difficult for researchers to know which of the needs along Allardt's dimensions a specific out-of-home activity helps to fulfil; how out-of-home activities map onto those dimensions likely varies between persons and across situations.

Evidently, undertaking out-of-home activities is not the only way to fulfil needs along Allardt's dimensions; in-home activities are also very important. Additionally, the extent to which needs can be fulfilled through out-of-home activities will depend on individuals' preferences, beliefs and desires (*cf.* Tonn 1984a), and people may also adjust ambitions and expectations regarding mobility and activity needs as capacities and resources change (Ziegler and Schwanen 2011). Still, it can be expected that the extent to which individuals' needs for out-of-home activity are fulfilled are a function of their opportunities for travel and hence the interplay between individual resources and abilities (e.g., health, access to a car, available time and social network) and the contextual conditions for mobility (e.g. residential location, quality of the public transport supply, available offer of activities and the timetables of facilities and services). Drawing on past research, we will outline below more specific expectations about factors that can potentially explain differences in the extent to which needs for out-of-home activity are unmet in later life.

Previous research and expectations

A precondition for activity participation is that activity opportunities are available within a reasonable travel distance. What constitutes a reasonable distance differs between geographical contexts, but at least in West and North Europe distances to most activities tend to be shorter in city-centres than in more rural areas. Moreover, the supply of activities is likely to be greater in the former type of area. Travel distances are not necessarily a barrier in later life: older people today travel more than previous cohorts, which is in part due to

better health and the later onset of age-related disabilities (Hjorthol et al. 2010; Rosenbloom 2001; Scott et al. 2009). Still, and notwithstanding variation among older adults of a given birth cohort, functional capacities tend to decline with ageing. This makes walking and cycling more demanding, travelling by public transport and driving a car more challenging, and unmet needs for out-of-home activity more likely (Kim 2011; Scheiner 2006).

Analysing Norwegian national travel surveys, Hjorthol and Sagberg (2000) have asserted that common age-related health conditions have greater effect on walking and using public transport than on car usage. Golob and Hensher (2007) have shown that in Sydney the preference to maintain car driving remains very strong in old age, and multiple studies have demonstrated strong associations of the availability of transport resources, such as holding a driving license and having access to a car, with trip frequency and actual out-of-home activities in old age (Marottoli et al. 2000; Schwanen et al. 2001; Siren and Hakamies-Blomqvist 2004) and with unmet activity needs (Kim 2011; Siren and Hakamies-Blomqvist 2004; Scheiner 2006). The importance and preference of the car in old age might be related to its compensatory qualities (Siren and Hakamies-Blomqvist 2004; Schwanen et al. 2012).

Holding a driving license is nonetheless differentiated according to gender in old age, even if the gap in driving license ownership among men and women has reduced considerably over time (Rosenbloom 2000; Hjorthol et al. 2010). After controlling for driving license ownership and socio-demographic factors, Siren and Hakamies-Blomqvist found no effect of gender on unmet activity needs. Scheiner (2006) on the other hand demonstrated a significant impact of gender on unmet activity needs when controlling for car availability, while Kim (2011) detected an effect of being a woman from a racial/ethnic minority but not of being female in general.

Car availability—and hence the ability to travel—is not only a function of having a driving license but also of financial resources. Moreover, it is likely that the ability to travel is greater if one can afford using taxis. Research has shown that income per person has a significant impact on trip frequency among people aged 55 and above in five different countries (Mollenkopf et al. 2005) and that household income has a significant impact on unmet activity needs among older people (Kim 2011), when all else is equal. Education is often highly associated with income, and Schwanen et al. (2001) found an effect of education and being employed on trip frequency among Dutch adults aged 50+, when controlling for other factors.

Some studies have found a significant effect of the size and structure of older people's social networks on trip frequency and out-of-home activity participation (Mollenkopf et al. 2005; Scheiner 2006). These findings might suggest that it is easier to get help for transport to activities if older people's social networks are greater. Alternatively, older people with greater networks may undertake out-of-home activities together with others more frequently. Companionship is no precondition for participation in many types of activity (including leisure), but out-of-home activities undertaken with others tend to be more enjoyable and fulfilling (Schwanen and Wang 2014) and barriers to activity participation outside the home can be lowered. Living with a spouse might also be an indicator of both transport resources (help for transport when having a partner who drives a car) and of access to company. However, both Schwanen et al. (2001) and Scheiner (2006) have found that living alone has a positive effect on trip frequency/out-of home activity participation. This has been explained with reference to greater need for out-of-home social activities among older adults who live alone.

Some studies have suggested that living in high-density areas has a positive effect on trip frequency and out-of-home activity participation in old age (Schwanen et al. 2001;

Siren and Hakamies-Blomqvist 2004) and that unmet activity needs in old age are greater in low-density than in high-density areas (Kim 2011; Siren and Hakamies-Blomqvist 2004), when controlling for socio-demographic factors. Such effects of high-density living seem to reflect proximity to destinations and better public transport supply in urban areas.

Previous studies of unmet needs for out-of-home activity (Kim 2011; Scheiner 2006; Siren and Hakamies-Blomqvist 2004) have not analyzed in great depth how unfulfilled needs are related to either actual activity participation or general outlook on life. Since activity participation is an essential means to satisfy needs (Allardt 1975), an inverse relation between the prevalence of unmet needs and the level of activity participation can be expected. Controlling for differences in actual activity engagement between older adults is also useful given Tonn's (1984a, b) argument that differences in the extent of unmet needs can occur when individuals' time use is identical. Taking general outlook on life, which is closely linked with personality, into consideration is equally important, because this shapes individual perceptions and experiences with regard to wellbeing (Bowling and Gabriel 2007; Diener and Suh 1997; Veenhoven 2002).

In summary, we expect the following sets of factors to be associated with the extent to which older people experience unmet out-of-home activity needs:

- *Individual resources and abilities for mobility*: travel and activity participation are enabled by such factors as health, driving license ownership, car availability, time availability;
- *Social support and network,* indicating whether older adults can mobilize support from their social network or the wider community to travel and undertake out-of-home activities and whether they have people with whom to undertake activities;
- *Actual participation in activities*;
- *General outlook on life*: the extent to which a person is satisfied with life in general is usually considered an 'outcome' measure of wellbeing but an alternative interpretation, which is supported by empirical evidence, suggests that life satisfaction reflects a partially biologically endowed, partially acquired long-term disposition of contentment and happiness (Lyubomirsky et al. 2005; Schwanen and Wang 2014);
- *Contextual conditions for mobility,* such as the supply of public transport (coverage and quality) and the residential location of the individual's household. The latter can be an indicator of both the distance to and supply of activities.

Data and methods

Participants

A survey about transport and activity participation in old age in Norway was conducted among 12,500 people aged 67—the country's official retirement age—and older in October–November 2011. The sample was randomly drawn from a national representative population database owned by TNS Gallup, a Norwegian survey company. The database only included people living in their private home; institutionalized older people are not considered in this study. A stratified sample design was utilized to ensure a large share of the oldest old in the net sample: 40 % of the 12,500 sampled individuals were between 67 and 79 years and 60 percent 80 or older.

The response rate was ±40 percent (N = 4,723), but actually higher if the more than 300 people are discounted who were unable to participate due to cognitive impairment,

institutionalization or because they had been deceased.[1] The net sample is slightly younger than the gross sample: 48 % is aged 67–79 years and 52 percent 80 years or older (Table 1).

Measures

The dependent variable in the analysis measures the degree to which older people have unmet needs for out-of-home activity participation. Table 2 lists the types of activities that have been considered. It is assumed that these activities are among the most common activities in the everyday life of older people and that they cover the dimensions of 'having', 'loving' and 'being' defined by Allardt (1975). Table 2 also indicates the dimension of needs with which each activity is likely to be associated. In light of the complex relationships between Allardt's dimensions and activity type (Sect. 2.1), we prefer an open and provisional mapping of those associations over authoritatively assigning each activity type to a single dimension. Table 2 therefore lists two dimensions for all but one activity type. The first dimension may be linked most strongly to a given activity type but the ranking of relative importance is tentative; it likely differs between individuals and across situations. Table 1

A single dependent variable has been constructed to measure the overall level of unmet needs for out-of-home activity participation. The choice to construct a single indicator reflects the complex relationships between Allardt's dimensions and activity type and aligns with the earlier studies by Siren and Hakamies-Blomqvist (2004) and Kim (2011). These authors have also focused on overall levels of unmet activity or travel needs, and our approach thus allows for useful comparisons of results across studies. The dependent variable has been constructed on the basis of the following question which in the Norwegian survey was asked for each activity type considered: *Would you have liked to participate in any of the following activities more often?* Respondents could answer 'yes', 'no', 'not relevant' to this question. The 'not relevant' option was included to filter out types of activity that were irrelevant to individual participants. Table 3 shows that needs for recreational outdoor walking, visits to family and friends, and visits to entertainment establishments (cinema, theatre, café, restaurant, etc.) are most often unfulfilled among study participants. Needs along the dimension of 'having' thus seem to be fulfilled to a greater degree than those of 'being' and 'loving'.

To measure the level of unmet needs for out-of-home activity participation, we constructed the following index at an interval measurement scale:

$$L_{ij} = \frac{\sum_j^J \mathrm{d}_{ij} \cdot \mathrm{a}_{ij}}{\mathrm{J} - \sum_j^J \mathrm{r}_{ij} \cdot \mathrm{a}_{ij}} \text{ for } 0 < \mathrm{a}_j < 9,$$

where L_{ij} is the overall level of unmet need for participation in out-of-home activities that individual i experiences and that is aggregated over activity types a_j; d_{ij} a binary indicator of whether participant i would like to conduct activity type a_j more often (1) or not (0); and r_{ij} a binary indicator of whether participant i considered activity type a_j relevant (1) or not (0). The index measures *the ratio of unmet needs divided by relevant needs* and the above formulation has two useful properties. It allows differences in the *degree* to which activity needs are unmet to be analysed and goes beyond the dichotomous indicators in Scheiner

[1] The number of people unable to participate is probably (considerably) higher than the 300 individuals who were reported as such by relatives and care-givers.

Table 1 Characterisation of participating older adults

	67–79 years old (n = 2,259) (%)	80 years and older (n = 2,453) (%)	All participants (n = 4,712) (%)
Gender			
Men	52	42	47
Women	48	58	53
Household income			
<NOK 200 k	17	38	27
NOK 200–399 k	43	44	44
NOK 400–599 k	27	14	20
NOK 600 k	13	4	9
Living status			
Married/partner	64	36	50
Widow/widower	20	52	36
Single	16	12	14
Car in the household			
Yes	85	54	69
No, but used to have	7	23	15
No, never had one	9	23	16
Driving license ownership			
Yes	84	49	67
No, but used to	5	23	14
No, never had one	11	28	19
Residential location			
City/town centre	12	15	14
Inner suburbs	20	21	20
Outer suburbs	41	39	40
Rural area	27	25	26
Frequency of public transport			
Several departures per hour	42	44	43
Once an hour	25	24	24
Less often	33	32	33
Distance to nearest public transport stop			
Less than 200 m	29	30	30
200–499 m	37	39	38
500–999 m	18	17	17
1,000 m or more	16	14	15
'Too few people to undertake activities with'			
Yes	10	15	13
No	90	85	87

(2006) and Kim (2011). Additionally, it corrects for the fact that a 'not relevant' response does not necessarily imply (dis)satisfaction with participation in a given activity, and excludes study participants who have responded 'not relevant' for all nine activity types from further consideration.

Table 2 Types of activity considered and their relationship with dimensions of needs

Activity type	Dimensions of needs
Grocery shopping	To have, as well as to love
Shopping for other goods	To have, as well as to love
Errands (e.g. bank, post office, pharmacy)	To have, as well as to love
Health care (visiting the doctor, dentist, physiotherapist)	To have
Recreational outdoor walking	To be, as well as to love
Exercise/gym outside the house	To be, as well as to love
Visit family and friends	To love, as well as to be
Meetings in organizations, clubs, etc.	To be, as well as to love
Visit the cinema, theater, café, restaurant, etc.	To be, as well as to love

Table 3 Share of study participants who would like to participate in a given activity more often

Activity type (a_j)	*n* older adults	Yes (%)	No (%)	Not relevant (%)
Shopping for grocery	3,989	9	86	6
Shopping for other goods	3,990	11	83	6
Errands (bank, post office etc.)	3,937	6	87	7
Healthcare (GP, dentist, physiotherapist etc.)	3,748	7	87	6
Recreational outdoor walking	3,828	43	49	8
Exercise/gym outside the home	3,699	18	58	25
Visit family and friends	3,868	38	58	4
Meetings in organizations, clubs, etc.	3,826	18	69	13
Visit the cinema, theatre, café, restaurant, etc.	3,864	30	57	14

The index ranges from zero to one: the closer the value is to one, the higher is the level of unmet need for out-of-home activities. For the 2,724 respondents for which the index can be calculated the average score is 0.22 (SD = 0.26). As the values for the index are non-normally distributed and 40 % of the respondents have a value of 0, ordinary linear regression analysis cannot be employed. We have therefore categorised the values into four classes and used ordinal regression analysis for the empirical analysis. The four categories are: no unmet needs (40 % of respondents), a few unmet needs (15 %), some unmet needs (24 %), and many unmet needs (20 %).

Independent variables

The selection of independent variables has been guided by the conceptual framework and expectations in Sect. 2.2. In addition to indicators of the individual's resources and abilities for mobility, social support and network, actual participation in activities and contextual conditions for mobility, the respondent's age and gender have also been included (Table 4). This is because age and gender are likely to shape individuals' resources and abilities for mobility in important ways and may pick up effects not captured by those other factors.

Most previous studies of trip frequency, out-of-home activity participation or unmet activity needs in later life have relied on objective indicators of individual resources and

Table 4 Independent variables

	Individual resources and abilities	Contextual conditions	Social support and network	Actual activity participation	Outlook on life
Household income	x				
Living status	x		x		
Self-rated health condition	x				
Health-related problems with walking	x				
Driving license ownership	x				
Help with transport: grocery shopping			x		
Help with transport: other purposes			x		
Distance to the nearest public transport stop		x			
Residential location		x			
Actual activity participation index				x	
General life satisfaction					x
Reasons for not undertaking out-of-home activity more often:					
Not enough time	x				
Cannot afford it	x				
Not have the energy (as I used to)	x				
No longer have a car	x				
Cannot drive anymore	x				
Poor supply of public transport		x			
Poor service of special car transport*		x			
Poor offer of leisure activities		x			
Too few people to undertake activities with			x		

* Publicly financed car transport is offered to people with disabilities who cannot or have large problems with using public transport. Persons receive a limited set of free rides/rides at strongly reduced prices with taxis per year

abilities, social support and network, and contextual conditions for mobility. This study considers both objective indicators and subjective evaluations of these dimensions. The latter consist of reasons for not participating in out-of-home activity more often that study participants who reported unmet activity needs are asked to provide.

People's actual participation in out-of-home activities is measured via a general index that summarises their engagement in the nine activity types considered. For each activity type respondents have been asked how often they participated:

- Almost every day (coded as 5)
- At least once a week (4)
- At least one a month (3)
- Less than once a month (2)
- Never/not relevant (1)

For each participant the scores for each activity type were summed and then divided by 9 to arrive at a score from 1 through to 5.

Statistical analysis

The ordinal regression procedure in SPSS was employed for the empirical analysis. We chose the complementary log–log link function for the transformation of the cumulative probabilities of the ordinal categories of the dependent variable (Garson 2012) as this reduces the likelihood that respondents are inaccurately allocated to the category of no unmet activity needs. A critical assumption in ordinal regression analysis is that the relationships between the independent variables and the logits associated with the categories of the dependent variable are statistically the same for all the categories of the dependent variable (Norusîs 2008). Thus, if plotted, the relationships between the logits and independent variables should consist of a set of parallel lines or planes—one for each category of the dependent variable (Norusîs 2008). A violation of the assumption of parallel lines means that the Chi square test cannot be interpreted and the regression coefficients may be biased. Tests of the parallel lines assumption for our models are reported below.

We have explored multiple model specifications to develop a deeper understanding of the determinants of the level of unmet activity needs than would have been possible if only a model containing all variables simultaneously was presented. The model specifications are as follows:

- *Model I*: Individual resources and abilities for mobility, social support and network, and contextual conditions for mobility, and gender and age;
- *Model II*: Model I, plus the actual activity participation index;
- *Model III*: Model II, plus general outlook on life (life satisfaction); and
- *Model IV*: Model III, plus the reasons provided by study participants for not participating in one or several activities more often.

Results

Table 5 shows that all four models pass the Chi square test for model fit, meaning that they are statistically superior to models that contain no other independent variables than constants (Norusîs 2008). For model IV the null hypothesis of parallel lines is initially rejected

Table 5 Summary statistics for the four ordinal regression model specifications (n = 2,552 older adults)

	Model I	Model II	Model III	Model IV
Model fit information				
Chi square/df	238/21	247/24	270/28	969/36
p value	0.000	0.000	0.000	0.000
Pseudo *R*-square				
Nagelkerke	0.097	0.100	0.110	0.344
McFadden	0.036	0.037	0.041	0.146
Test of parallel lines				
Chi square/df	56/42	61/48	65/56	397/72
p-value	0.067	0.102	0.196	0.000

with 95 % confidence, implying that the regression coefficients are not the same for all four categories. However, the significant outcome for the parallel lines test can be due to a combination of many cases and many independent variables in the model (Garson 2012). A widely accepted way to test whether this is the case is to re-estimate the model parameters on a subset of cases that are randomly extracted from the original set (*ibid.*). This re-estimation rendered no statistically significant ($p < 0.05$) outcomes for the parallel lines test and no marked changes in the regression coefficients. We therefore conclude that the results for model IV presented below are statistically valid.

Individual resources and abilities for mobility, social support and network, contextual conditions for mobility, and gender and age

The results for model I (Table 6) suggest that health status has a clear impact on the extent of unmet needs for out-of-home activity: older people who perceive their own health as good have the least unmet needs and those in poor health the most. Health-related problems with walking also have a statistically significant ($p < 0.05$), positive impact on unmet needs. However, the difference between having none and some problems is much larger than between some and great problems. Thus, the difference between the presence and absence of problems with walking matters more than the severity of such problems to the level of unmet activity needs.

Driving license ownership also has a clear impact on the extent of unmet activity needs. Those with a license tend to have unmet needs for fewer out-of-home activities than those who do not, no matter whether the latter have held a license previously in the life-course or not. That former drivers have more unmet needs than those who still drive aligns with the extensive literature showing that driving cessation implies reduced out-of-home activities (Marottoli et al. 2000), increased depressive symptoms (Marottoli et al. 1997; Fonda et al. 2001; Ragland et al. 2005; Windsor et al. 2007) and a perceived loss of independence and freedom (Yassuda et al. 1997; Adler and Rottunda 2006; Davey 2007). The lack of differentiation in terms of unfulfilled activity needs between ex-drivers and those who have never driven may surprise some readers. The existing literature seems to suggest that ex-drivers may have more unfulfilled activity needs than never-drivers, given that the former have previously in the life-course been accustomed to the flexibility that being driving offers, often understand no longer being able to drive in terms of loss, and frequently struggle to adapt to life 'after the car' (Adler and Rottunda 2006; Davey 2007; Schwanen

Table 6 Ordinal regression analysis of unmet needs for out-of-home activity, models I–VI (n = 2,552 older adults)

	Model I		Model II		Model III		Model IV	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Ord_index = .00	−1.253	***	−1.146	***	−1.410	***	−1.030	***
Ord_index = 1.00	−0.804	***	−0.697	***	−0.958	***	−0.497	
Ord_index = 2.00	−0.071		−0.038		−0.219		0.368	
Gender (M = 1; F = 2)	0.033		0.043		0.047		0.006	
Age (<80 = 1; ≥80 = 2)	−0.019		−0.023		−0.018		0.037	
Living status (Other = 1; Living alone = 2)	−0.130	**	−0.129	**	−0.154	***	−0.150	***
Household income								
Unknown	−0.065		−0.077		−0.101		−0.194	
< NOK 200 k	0.081		0.073		0.071		−0.063	
≥ NOK 200 k	0		0		0		0	
Health condition								
Good	−0.471	***	−0.486	***	−0.318	***	−0.413	***
Neutral	−0.257	**	−0.272	***	−0.175		−0.265	**
Poor	0		0		0		0	
Health−related problems with walking								
Unknown	−0.100		−0.102		−0.115		−0.060	
None	−0.218	**	−0.216	**	−0.223	**	−0.235	**
Some	−0.052	*	−0.054		−0.072		−0.107	
Great	0		0		0		0	.
Driving license ownership								
Yes	−0.308	***	−0.301	***	−0.285	***	−0.245	***
No, but I used to	−0.012		−0.011		−0.009		−0.188	*
No, I never had one	0		0		0		0	

Table 6 continued

	Model I		Model II		Model III		Model IV	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Help with transport: Grocery shopping								
Unknown	0.006		−0.001		−0.016		−0.091	
Yes	0.203	***	0.197	***	0.201	***	0.060	
No	0		0		0		0	
Help with transport: Other purposes								
Unknown	0.093		0.101		0.101		0.157	
Yes	0.151	***	0.152	***	0.161	***	0.100	*
No	0		0		0		0	
Distance to nearest public transport stop								
Unknown	−0.181		−0.164		−0.158		−0.170	
Less than 200 m	−0.087	*	−0.088	*	−0.083		−0.034	
200 m or more	0		0		0		0	
Residential location								
City/town centre	−0.105		−0.101		−0.076		0.023	
Inner suburbs	−0.024		−0.018		−0.007		0.094	
Outer suburbs	0.010		0.023		0.036		0.105	*
Rural area	0		0		0		0	
Actual activity participation index								
Very low			0.112		0.094		0.299	***
Moderately low			0.191	***	0.180	***	0.342	***
Fairly high			0.135	**	0.133	**	0.210	***
High			0		0		0	

Table 6 continued

	Model I		Model II		Model III		Model IV	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Life satisfaction								
Unknown					−0.844	**	−0.808	**
Not satisfied					0		0	
Somewhat satisfied					−0.095		−0.226	
Satisfied					−0.369		−0.367	
Very satisfied					−0.522	**	−0.427	*
Living status (Other = 1; Living alone = 2)							−0.150	***
Not enough time (no = 0; yes = 1)							0.960	***
Cannot afford it (no = 0; yes = 1)							0.881	***
Not have the energy (as I used to)							0.513	***
No longer a car (no = 0; yes = 1)							0.445	***
Cannot drive anymore (no = 0; yes = 1)							0.447	***
Poor supply of public transport (no = 0; yes = 1)							0.753	***
Poor service of special car transport (no = 0; yes = 1)							0.701	***
Too few people to undertake activities with (no = 0; yes = 1)							0.878	***

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

and Páez 2010). This struggling tends to be compounded by limited competence and confidence in using public transport and particularly strong preferences to not depend on others for rides among ex-drivers (ibid.). However, never-drivers may always have experienced difficulties with fulfilling activity needs, for instance because they lacked access to any mode of transport commensurate with their needs and capabilities. Moreover, studies demonstrating negative effects of driving cessation later life have been undertaken predominantly in strongly car-oriented societies (e.g. USA and Australia) where not being able to drive may have more negative connotations than in many European countries. Perhaps adapting aspirations and expectations regarding mobility is easier for Norwegian than for North-American or Australian ex-drivers. Whatever the reasons, our analysis foregrounds the importance of a driving licence to the level of unmet activity needs among older people.

An unexpected finding is that older adults who get help from outside the household to undertake trips for either grocery shopping or other purposes have more unmet needs than those without such help. It appears that, once other factors are controlled, help from one's social network and community does little to mitigate unmet activity needs in later life. Given that further bivariate analysis has indicated that respondents who receive help with grocery shopping and other trips tend to be on lower incomes and in poorer health (and do not own a driving license), receiving help for transport needs to be understood in the current study as signifying a great risk of mobility disadvantage and unmet activity needs. The findings in Table 6 might hence reflect that the help with transport to which many older people have access is perceived as inadequate. Older people reliant on such help may find it difficult to access activities at certain destinations and/or times (for instance, when relatives are engaged in paid employment). Yet it is also possible that older people who rely on informal help from others—relatives, neighbours, friends—minimise the instances in which they use help. Such self-censoring is often driven by feelings of guilt and pride and a will to be (seen by others as) independent, and is widely documented in relation to everyday travel and activities in Anglo-American countries (e.g. Portacolone 2011; Schwanen et al. 2012). Further research using qualitative methods is required to examine the relations among social support, activity participation and need in greater depth.

Living status is also associated with the level of unmet activity needs: older people living alone tend to have fewer unmet activity needs than those live with a spouse/partner. It is likely that older adults who have lived alone for a long time are on balance more competent in getting out and about, given that their need for socialising with people living elsewhere is likely to be stronger than among older people living with a spouse/partner.

The quality of public transport from the respondents' residential location has, via distance to the nearest stop, a non-linear impact on the level of unmet activity needs. Only when a single and low threshold is used—*i.e.*, the distance to the nearest stop is within 200 m from an older person's home or not—does the supply of public transport produce a statistically significant ($p < 0.10$) impact. Thus the effect of public transport on the level of unmet needs is spatially constrained to a small buffer around stops once the confounding effects of perceived problems with walking are controlled. A fine-grained public transport network with many stops is required if public transport accessibility is to have a positive effect on the wellbeing of older adults.

During the modelling process we also examined the potential impact of the frequency of public transport services around the residential location on the level of unmet activity needs. As this produced no statistically significant results, the variable was dropped from the model. The overall frequency of service may be too simple as an indicator: not only does the level of supply often vary markedly over the course of the day and week, it is also

the level of connectivity to destinations (including the number of required transfers) rather than the number of available services that older people find important (Schwanen et al. 2012).

Residential location has *ceteris paribus* no statistically significant ($p < 0.10$) effect on the level of unmet needs for out-of-home activity participation. Together with the results for public transport supply, this outcome suggests that contextual conditions for mobility are of minor importance in explaining the level of unmet activity needs. Other factors with no direct effect according to model I are age, gender and household income. Insofar as these shape the level of unmet activity needs, their effects are indirect and operate through variations in self-perceived health, social networks, transport resources and living status.

Actual activity participation and outlook on life

In model II actual participation in activities is added as independent variable (Table 6). As expected, this factor is inversely related to the level of unmet needs although the relation is not entirely linear: respondents who undertake few out-of-home activities have more unmet needs than those who undertake many activities. This might suggest that older people with a given actual activity level value activities differently, due to differences in beliefs about how these activities fulfil needs, and hence have different needs (and unmet activity needs), as suggested by Tonn (1984a, b). The estimated regression coefficients for the other factors resemble those in model I.

As an indicator of overall outlook on life, older adults' satisfaction with life in general is also inversely related to unmet need for out-of-home activities (model III, Table 6): as the participants are more satisfied with life, they have fewer unmet needs, which suggests that the extent to which a person believes that his/her needs are fulfilled varies with personality traits. Bivariate analysis also suggests that life satisfaction is positively correlated with lower age, higher income, being married/living with a partner, good health, the absence of health-related problems with walking, having a car in the household, and holding a driving license. Among these variables, health condition correlates much more strongly with life satisfaction compared to the other variables, which also explains that only the effect of this variable is reduced with the inclusion of life satisfaction in model III.

Reasons for not participating in activities more often

The inclusion of subjective reasons for limited activity participation in model IV increases the goodness-of-fit considerably, as the differences in the Chi square and McFadden rho-square statistics between specifications III and IV (Table 5) attest. The reasons are considerably more effective in explaining variations in the level of unmet activity needs than the measures of resources and abilities for mobility, social support and network, contextual conditions and actual participation in activities discussed previously.

According to model IV (Table 6), the level of unmet needs for out-of-home activities is higher among those older people who believe that: they do not have enough time to undertake all the activities they would like to pursue; they cannot afford all such activities for financial reasons; public transport supply is too poor; the special car transport service is too poor; they have too few friends with whom they can undertake activities; and they cannot drive anymore or no longer own a car. Most of these reasons reflect challenges that are associated with the 'Fourth Age'—the age of dependence, decline and frailty (Laslett 1989). However, the reason 'I don't have enough time' suggests that people in the 'Third Age' of health, personal fulfilment and active ageing (Laslett 1989) can also experience

unmet needs for out-of-home activity participation, possibly because 'they want it all' (or at least too much). Whatever the reason, the results demonstrate that unmet needs for out-of-home activity participation cannot only be explained by older people becoming frail and loosing resources.

The coefficients of the reasons of no longer able to drive or owning a car are smaller in magnitude than those for most other reasons included in model IV.[2] Supplementary analysis has indicated that this difference in coefficient size reflects both that ex-drivers only make up 1/8 of the older people who are considered in the analysis, and that non-driving related reasons weigh more heavily among ex-drivers. It should also be borne in mind that important factors that make people give up driving, such as poor health, are already included in the model. With the inclusion of the reason variables the difference between ex-drivers and people who have never owned a driving license has become statistically significant at ($p < 0.10$); the level of unmet activity needs among ex-drivers is now closer to people with a driving license than to never-drivers. The change in coefficients compared to models I-III reflects both the inclusion of beliefs around driving ability and car ownership and beliefs about affordability, energy and social networks; for a number of ex-drivers the second set of beliefs may also have played a role in the decision-process that led to the relegation of their driving license.

A comparison of models III and IV shows that the inclusion of the reason variables has little impact on the regression coefficients for most other factors. The most noticeable changes are that the effects of help for transport to conduct grocery shopping and distance to the nearest public transport stop are no longer statistically significant, whilst residential location now has a statistically significant effect (all at $p < 0.10$). Older adults living in outer suburbs tend to have more unmet needs for out-of-home activities than their counterparts in cities and rural areas. This finding may reflect that expectations and aspirations regarding out-of-home activity participation are greater among older adults in (outer) suburbs than in rural areas. This in turn might be due to a greater supply of activity opportunities in urban areas than in rural areas, and within the former lower levels of accessibility in outer than in inner neighbourhoods.

For several pairs of variables in model IV the subjective evaluation—reasons—offered by respondents themselves are more strongly associated with the level of unmet needs for out-of-home activity than the objective indicator (which is one reason why the Chi square and McFadden Rho-square values for model IV are more than three times those for model III). This is particularly evident for the availability of monetary resources and the supply of public transport. While the objective indicator of household income is not related to the level of unmet need, respondents' perception of monetary resources—captured through 'cannot afford it'—does have a statistically significant effect. This difference seems to suggest that people's actual income does not reflect their beliefs regarding financial resources. Whilst distance to the nearest public transport stop and frequency of public transport services have no statistically significant impacts in model IV, the reason 'poor public transport supply' is clearly associated with the level of need for out-of-home activities. This discrepancy reinforces the earlier argument about distance to the nearest stop and frequency of service being too crude as indicators of public transport quality. However, it may also reflect a disjuncture between the actual supply of public transport and older people's perceptions and understandings of it: they may lack cognitive knowledge of the services on offer, the competence or the confidence to use public transport. Either way,

[2] Because all reason variables are measured on the same scale and with identical response categories, a comparison of the estimated regression coefficients provides an indication of their relative importance.

other indicators than distance to the nearest stop or frequency of service are needed in quantitative research of how older adults—and possibly other social groups—use and experience public transport.

Discussion and conclusions

This study among a stratified random sample of older adults in Norway indicates that transport plays an important role in the extent to which needs along Allardt's (1975) dimensions of 'having', 'loving' and 'being' can be met through out-of-home activities. It has shown that the level of unmet needs is shaped by both objective and subjective indicators of individual-level resources and abilities for mobility and contextual conditions for mobility. Actual participation in activities, which is shaped by transport-related factors in important ways, also helps to explain variations in the level of unmet needs. Nevertheless, other factors need to be considered too: older people's health condition and health-related problems with walking, as well as living status (living with a partner/spouse), having social support and a social, and outlook on life (overall life satisfaction) are associated with the level of unmet activity needs.

The study contributes to the existing academic literature in various ways. It indicates that, for researchers interested in wellbeing and transport, analysing subjective evaluation of need fulfilment offers a workable alternative to studies of travel satisfaction or the relationships of trip making with some indicator of life satisfaction (Ettema et al. 2010; Stanley et al. 2011; De Vos et al. 2013), as well as to the use of objective indicators of the fulfilment of travel and activity needs such as trip rates or activity frequencies. An advantage of our approach over the use of objective indicators of need fulfilment is that the (implicit) assumption of preference neutrality across individuals is forgone. This assumption is made, for instance, when high trip rates or activity frequencies are taken to indicate high levels of need fulfilment. The subjective assessment of unmet activity needs can complement studies of travel satisfaction (e.g. Ettema et al. 2010) as the latter only consider travel that is actually undertaken; unmet needs for travel or activities is not considered. Such unmet needs are to some extent indirectly addressed in studies of the links between travel behaviour and life satisfaction indicators (e.g. Stanley et al. 2011). However, as we have argued elsewhere (Nordbakke and Schwanen 2014), life satisfaction indicators are rooted in hedonic understandings of wellbeing according to which the maximisation of pleasure and preference satisfaction constitutes wellbeing. There is also a broader and competing eudaimonic perspective according to which realising one's true potential ('daimon') constitutes wellbeing; a needs approach to wellbeing as elaborated in the current paper is in close alignment with this eudaimonic perspective (ibid.).

A second contribution relative to earlier studies on unmet activity/travel needs (Kim 2011; Scheiner 2006; Siren and Hakamies-Blomqvist 2004) is that unmet activity needs are not merely a function of age, gender, education, health, car availability, driving license ownership and residential location. These factors help to explain the level of unmet activity needs in the Norwegian sample as well, but general outlook on life, which is closely linked with personality traits, and actual level of activity are also important predictors. The findings suggest that older people with a given actual activity level value activities differently and that this explains differences in the extent to which needs are fulfilled (Tonn 1984a, b), when other important factors have been controlled. The study has also raised the prospect that the use of comparatively easily available, objective information on resources for mobility and contextual conditions is inadequate for explaining the level of unmet

activity needs among older people and possibly other social groups. This is because our analysis indicated that objective measures of household income and distance to nearest public transport stop were not related to the level of unmet activity needs, whereas the subjective evaluations 'cannot afford it' and 'poor public transport supply' did have statistically significant impacts

Finally, the study also shows that unmet needs for out-of-home activity participation do not result from loss of mobility, decline and frailty in old age alone. 'Fourth age' factors (Laslett 1989), such as poor health, problems with walking and loss of social contacts are obviously important but unmet activity needs can also occur for other reasons, including lack of time. These findings highlight that older people are a heterogeneous group and that ageist stereotypes of old age as a time of inevitable decline, dependency and immobility are best avoided if transport researchers wish to understand the travel behaviour and needs in later life.

Several avenues for further research can be identified. First, given the large levels of unexplained variance in the ordinal regression models (Table 5), many explanatory factors appear to have been missing from the analysis. Thus, future work on unfulfilled needs for travel and activity in later life would benefit from paying greater attention to some of the transport-related barriers that can prevent older people from going out. A range of such barriers have been identified in the literature, including weather and climate; fear of falling; walking uphill (and downhill in the winter); fear of robbery, assault and harassment; fear of traffic accidents; inconsiderate car drivers; lack of comfort in the form of limited availability of benches and toilets in (semi)public space; problems with boarding public transport vehicles; overcrowded public transport vehicles; and negative attitudes towards aged people (Hovbrandt et al. 2007; Risser et al. 2010; Nordbakke 2013). Nordbakke (2013) has also identified a series of potentially relevant barriers at the destination end of trips, such as the location of parking facilities, entrance barriers to buildings (e.g., stairs) and the timing of activities (e.g. cinema and theatres in the evening). Second, the links and interactions, including substitution (e.g. Yamamoto and Kitamura 1999), between in-home and out-of-home activity participation in relation to need fulfilment should be addressed in future research. Third, the complex linkages between Allardt's (1975) dimensions of 'to have', to love' and 'to be' and different activity types need to be examined further. The use of qualitative methods would be particularly useful to unravel the nature of those linkages and the extent to which these differ between individuals and across situations for one and the same individual.

Nevertheless, our study has identified important transport policy levers for facilitating the fulfilment of needs for out-of-home activity participation in later life. For instance, policymakers should think critically about distance to public transport stops when seeking to reduce unmet activity needs. Distance decay in the effects are likely to be strong; in this study benefits were only detectable within 200 meters from a stop, suggesting that this is an important threshold in older Norwegians' willingness and ability to walk to a public transport stop. In addition, model IV seems to suggest that for many older people the critical issue is not so much whether public transport is available in close vicinity of their home (distance to nearest public transport stop) but the connectivity to destinations that is offered at the times of the day and week that they want or need to travel ('poor public transport supply').

The importance of maintaining the ability to drive a car in later life is also evident. Our study echoes previous research (Siren and Hakamies-Blomqvist 2004; Kim 2011) in showing that being able to drive reduces unmet activity needs. It also suggests that perceived lack of financial resources is a reason for not undertaking out-of-home activities.

Given that car ownership may at some moment become unaffordable for older people (e.g. due to loss of a spouse or a gradual decline in real terms of one's pension), it is important that transport and social policies not only maintain or develop older people's driving skills and abilities but also ensure that owning and using a car remain financially feasible in later life.

Perhaps the most significant implication follows from the conclusion that transport-related factors alone cannot explain all variations in the extent of unmet activity needs in old age: policymakers should move beyond a sectorial orientation to develop holistic approaches whereby questions of mobility in later life are not only or even primarily tackled through transport planning. Such questions need to be addressed in close conjunction with health and social care professionals, urban planners, operators of leisure activities, and other stakeholders.

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