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Perceived environmental barriers to outdoor mobility and changes in sense of autonomy in participation outdoors among older people: A prospective two-year cohort study

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**Perceived environmental barriers to outdoor mobility and changes in sense of autonomy
in participation outdoors among older people: A prospective two-year cohort study**
Aging and Mental Health

Objective: The aim was to study whether perceived environmental barriers to outdoor mobility affect changes in sense of autonomy in participation outdoors among community-dwelling older people over a two-year period.

Methods: Community-dwelling people aged 75-90 years (n=848) in central Finland were interviewed on two occasions, face-to-face at baseline and over the telephone two years later. Perceived environmental barriers to outdoor mobility were assessed using a 15-item structured questionnaire, and the sum scores categorized into tertiles (0, 1 and 2 or more barriers). Autonomy in participation outdoors was assessed with the 'Impact on Participation and Autonomy' (IPA) questionnaire using the autonomy outdoors subscale (score range 0-20, higher scores indicating more restricted autonomy).

Results: Scores for autonomy in participation outdoors were available for 848 participants at baseline (mean 6.2, SD=3.8) and for 748 participants at the two-year follow-up (mean 6.7, SD=3.9). At baseline, those reporting multiple environmental barriers had the most restricted autonomy, while those reporting no environmental barriers had the least restricted autonomy ($p<.001$). Over the follow-up, autonomy in participation outdoors declined more among those reporting multiple environmental barriers compared to those reporting none (age and sex-adjusted group*time $\beta=.629$, s.e.=.277, $p=.023$). Adjustment for cognitive functioning, education, number of chronic conditions and change in walking difficulty did not influence the association.

Conclusion: Perceived environmental barriers to outdoor mobility accelerate the decline in autonomy in participation outdoors among older community-dwelling people. Understanding factors affecting autonomy can help in finding ways to support the sense of autonomy as people age.

Key words: Environment, autonomy, participation, mobility, ageing

INTRODUCTION

The maintenance of autonomy with increasing age is a key goal for individuals and policy makers (World Health Organization (WHO), 2002). Autonomy is defined as “the perceived ability to control, cope with and make personal decisions about how one lives on a day-to-day basis, according to one’s own rules and preferences” (World Health Organization (WHO), 2002). It has been suggested that autonomy has both a physical and a psychological dimension (Hofland, 1990). The physical dimension refers to freedom of mobility and low levels of physical restrictions, including use of the environment, while the psychological dimension refers to control over one’s environment and ability to control, and make choices about, one’s life. However, we are not aware of studies focusing on the association between environmental barriers to outdoor mobility and changes in sense of autonomy in participation outdoors.

The ability to go outdoors is important for the maintenance of autonomy (World Health Organization (WHO), 2002). Environmental barriers restrict people’s possibilities to participate in outdoor activities (Christensen, Holt, & Wilson, 2010; Gray, Hollingsworth, Stark, & Morgan, 2008), thereby jeopardizing their possibilities to run daily errands independently (Adams et al., 2013; Beard et al., 2009). Previous reports indicate that perceived environmental barriers outdoors are associated with physical inactivity (Dawson, Hillsdon, Boller, & Foster, 2007), low frequency of social participation (Richard, Gauvin, Gosselin, & Laforest, 2009), increased risk for development of walking difficulties (Balfour & Kaplan, 2002; Rantakokko, Iwarsson, Manty, Leinonen, & Rantanen, 2012), and subsequent poor quality of life (Rantakokko et al., 2010). It has also been found that

perceived environmental barriers contribute to loneliness in part through reduced autonomy in participation outdoors (Rantakokko et al., 2014). Also a recent study among older adults with spinal cord injury showed that accessibility problems are associated with restriction in autonomy outdoors (Pettersson, Brandt, Lexell, & Iwarsson, 2015), but since these findings were based on cross-sectional data, the temporal order of the association is not known.

Changes in health and life situations may impact on independence and the possibilities to fulfil social roles (Gignac et al., 2013). In particular, walking difficulties are common in old age and poor mobility often coincides with a reduced sense of autonomy (Portegijs, Rantakokko, Mikkola, Viljanen, & Rantanen, 2014). Granting that human behaviour is a reflection of the capabilities of a person in interaction with the environment where that person lives (Lawton & Nahemow, 1973), changes in mobility need to be taken into account when studying environmental influences on changes in autonomy with aging.

The purpose of this study was to examine whether perceived environmental barriers to outdoor mobility predict changes in older community-dwelling people's autonomy in participation outdoors over a two-year period. The findings may help identify factors underlying autonomy in old age. Such information helps in the planning of interventions aiming to increase sense of autonomy among older people and has implications for planning age-friendly communities that support autonomy of older people.

METHODS

Study design and participants

The data are drawn from the “Life-space mobility in old age” (LISPE) project, a two-year prospective cohort study on individual and environmental determinants of life-space mobility among community-dwelling, urban and rural inhabitants in central Finland. The study design and methods have been reported in detail previously (Rantakokko et al., 2015; Rantanen et al., 2012). Briefly, a random sample of people aged 75-90-years (N=2550) was obtained from the national population register, contacted by a letter and over the phone to assess eligibility and willingness to participate. The inclusion criteria were: community-dwelling in the study area and able to communicate. A total of 848 people were considered eligible, were willing to participate and were interviewed in their homes at spring 2012. Of these, 761 (90 %) participated in the two-year follow-up telephone interviews. The interviews were conducted by trained health science students and the average duration of the baseline interviews was 1.5 hours.

The LISPE project was approved by the Ethical Committee of the University of Jyväskylä, Finland. All participants signed an informed consent.

Measurements

Sense of autonomy in participation outdoors

Sense of autonomy in participation outdoors was assessed at baseline and two-years later using the Finnish version of the Impact on Participation and Autonomy (IPA) questionnaire, domain “autonomy outdoors” (Cardol, de Haan, de Jong, van den Bos, & de Groot, 2001; Kanelisto & Salminen, 2011). IPA is found to be a valid and reliable instrument to study participation and autonomy in various clinical populations and in older adults (Cardol et al.,

2001; Sibley et al., 2006). In the present study, Cronbach's alpha for 'autonomy outdoors' scale was 0.86. The participants were asked to rate in general their chance of 1) visiting relatives and friends when they want, 2) going on the sort of trips and holidays they want, 3) spending leisure time the way they want, 4) meeting other people as often as they want, and 5) living life the way they want. The response categories ranged from 0 (very good) to 4 (very poor). A sum score (range 0-20) was calculated; higher scores indicate more restrictions in autonomy in participation outdoors.

Perceived environmental barriers to outdoor mobility

Using the checklist for perceived environmental barriers to outdoor mobility (PENBOM), 15 environmental barriers were assessed to identify those environmental barriers (yes/no) that people perceive as hindering their possibilities for outdoor mobility (Rantakokko et al., 2014). The perceived environmental barriers to outdoor mobility are shown in Table 1. In the analyses, the environmental barriers reported as present were summed and then categorized into tertiles (0, 1 and 2 or more barriers).

Covariates

Difficulty in walking 500 m was self-reported at baseline and two years later as no difficulties vs. difficulties (minor, major, or unable). Change in walking difficulty was categorized as 'stable', 'declined', 'improved'.

Other covariate information was obtained at baseline. Years of education was self-reported. Participants were asked to report their chronic conditions diagnosed by a physician, using a list of 22 prevalent diseases and an additional open-ended question about any other chronic condition (Portegijs et al., 2014). After the interview, responses in the open-ended question were checked by a physician and when relevant included in the number of chronic conditions

which was subsequently calculated. Cognitive functioning was assessed with the Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975).

Statistical analyses

To compare changes in the IPA subscale score in the tertiles of environmental barriers over the follow-up, we used the Wald test by applying the delta method (Raykov & Marcoulides, 2004) to the estimated mean parameters and the parameter covariance matrix. The percentage change in IPA score was calculated for each individual ($P_i = (FU_i - BL_i) / BL_i \times 100$).

Perceived environmental barriers as predictors of change in autonomy in participation outdoors was studied by constructing Generalized Estimating Equation (GEE) models (Liang & Zeger, 1986) with unstructured working correlation matrix. First, the GEE model was adjusted for gender and age, and then covariates (education, cognitive functioning, number of chronic conditions, change in walking difficulty) were added to the model one by one until the final model included all the covariates.

Those who died (n=41) or were admitted to institutional care (n=15) during the follow-up were excluded from the analyses and data were not imputed for them. Those who were excluded from the analyses were older (p=.001), had more often walking difficulties (p=.001), and had higher IPA scores (p=.001) at baseline. No differences were found in perceiving environmental barriers (p=.302). Also baseline association between environmental barriers and autonomy in participation outdoors was similar compared to those included in the study.

In cases of missing data on the outcome variable among those remaining in the follow-up sample, the multivariate imputation by chained equations (MICE) procedure was used (Azur,

Stuart, Frangakis, & Leaf, 2011). Accordingly, data on autonomy in participation outdoors were imputed for 44 participants, and thus the age- and sex-adjusted GEE analyses were performed with data from 792 participants. Of these, 36 had missing information on change in walking difficulty and 8 had missing information on year of education, and were not included in the fully adjusted analyses. Accordingly, the final model included 748 participants.

IBM SPSS Statistics 22 (SPSS Inc., Chicago, IL) was used for statistical analyses, and statistical significance was set at $p < .05$.

RESULTS

The participant characteristics and the frequencies of perceived environmental barriers to outdoor mobility at baseline are presented in Table 1. The most common barrier to outdoor mobility was snow and ice, followed by hills in the nearby environment, cyclists in the walkways, poor street condition and lack of resting places.

The items of “autonomy outdoors” subscale at baseline and at the two-year follow-up are shown in Table 2. The mean sense of autonomy in participation outdoors score at baseline was 6.2 (SD=3.8) and at the two-year follow-up 6.7 (SD=3.9) indicating statistically significant decrease in autonomy over time ($p<.001$). At baseline, 25 % reported walking difficulties. Over the two-year follow-up period, most of the participants reported no changes in their walking difficulty (73% remained stable, 10% declined and 6% improved).

Table 3 shows the mean values for autonomy in participation score at baseline and at two-year follow-up according to number of environmental barriers to outdoor mobility. For those reporting no environmental barriers at baseline autonomy in participation outdoors remained almost unchanged. Autonomy in participation outdoors declined more among those reporting multiple environmental barriers compared to those reporting none (age and sex-adjusted group*time $\beta=.629$, $se=.277$, $p=.023$). Adjustment for cognitive functioning, education, number of chronic conditions and change in walking difficulties had no influence on the association. For those reporting only one environmental barrier no group*time interaction was observed (Table 3).

DISCUSSION

This study shows that perceived environmental barriers to outdoor mobility predicts decline in autonomy in participation outdoors, taking into account individual differences in walking difficulties, health, and cognitive functioning. This finding is novel, yet in line with previous studies showing that perceived environmental barriers restrict community-dwelling older people's possibilities for outdoor mobility (Clarke & Gallagher, 2013) and physical activity participation (Adams et al., 2012; Dawson et al., 2007; Granner, Sharpe, Hutto, Wilcox, & Addy, 2007). This study adds knowledge on the influence of environmental factors on older people's satisfaction with their possibilities to live their life as would like and to make autonomous decisions related to daily life.

It has previously been shown that perceived environmental barriers increase the risk for walking difficulties in older people (Rantakokko et al., 2012) and that walking difficulties often coincides with a lower sense of autonomy (Portegijs et al., 2014). Thus in the present analyses we took into account possible changes in walking difficulty over a two-year period. The results showed that including this variable had no influence in the association between perceived environmental barriers and restricted autonomy in participation outdoors. Thus we know that the change in autonomy in participation outdoors was not due to changes in walking difficulty. This finding strengthens the evidence that environmental barriers may precede restriction in autonomy in participation outdoors among community-dwelling people.

The mean decline in the autonomy in participation outdoors score was over 10% among those reporting one or more environmental barriers. It is currently unknown whether this is a meaningful change or not. However, one might argue that the question of meaningfulness in relation of autonomy is irrelevant since the answers reflect respondents' immediate personal

perceptions of their possibilities to live life in the way they wish, and consequently any change can be considered meaningful. Maintenance of autonomy is a key goal of the WHO's active ageing policy (World Health Organization (WHO), 2002), and even a slight decrement in autonomy has, without a doubt, an effect on one's everyday life.

The strengths of the present study are a large population-based sample of community-dwelling people over 75 years of age, a longitudinal study design, and a topic that has not been widely studied. There are, however, some limitations that should be noted. The study participants were relatively well-functioning older people, only 25 % of whom had difficulties in walking at the baseline. We also excluded participants who died or were institutionalized during the follow-up. At baseline, they reported more restriction in autonomy in participation outdoors and more difficulties in walking. Consequently, those with worse mobility are underrepresented in the study, a defect which could mean that the results underestimate the true situation in the general population of older people.

In conclusion, perceived environmental barriers to outdoor mobility accelerate the decline in autonomy in participation outdoors, thus affecting older people's possibilities to live life as they wish. Further research should focus on whether positive features of the environment, such as parks, and the nature and proximity of services, would enhance older people's sense of autonomy.

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TABLE 1. Participant characteristics and perceived environmental barriers to outdoor mobility at baseline (n=848).

| | Mean | (SD) |
|--|-------------|-------------|
| Autonomy in participation outdoors, score | 6.2 | (3.8) |
| Age | 80.6 | (4.2) |
| MMSE, score | 26.1 | (2.8) |
| Chronic conditions, number | 4.4 | (2.4) |
| Education, years | 9.6 | (4.1) |
| | % | (n) |
| Women | 62 | (526) |
| Difficulty walking 500m | 25.6 | (217) |
| Number of perceived environmental barriers | | |
| 0 | 32.4 | (275) |
| 1 | 20.9 | (177) |
| ≥ 2 | 46.7 | (369) |
| Perceived environmental barriers to outdoor mobility | | |
| Snow and ice in winter | 52.9 | (449) |
| Hills in the nearby environment | 23.7 | (201) |
| Cyclists in the walkways | 18.9 | (160) |
| Poor street condition | 18.8 | (159) |
| Lack of resting places, winter /summer | 18.8 / 15.7 | (159 / 133) |
| Long distances to services | 11.8 | (100) |
| Dangerous crossroads | 9.2 | (78) |
| Busy traffic | 8.4 | (71) |

| | | |
|-------------------------------------|-----|------|
| High curbs | 7.5 | (64) |
| Insecurity due to other pedestrians | 5.4 | (46) |
| Noisy traffic | 3.8 | (32) |
| Poor lighting | 3.3 | (28) |
| Lack of pedestrian zones | 3.2 | (27) |
| Cars in the walkways, service vans | 1.7 | (14) |

TABLE 2. Items of Autonomy Outdoors subscale at baseline (n=848) and at the follow-up (n=748)

| | Very good % | Good % | Fair % | Poor % | Very poor % |
|--------------------------------|----------------|-----------|-----------|-----------|----------------|
| BASELINE (n=848) | | | | | |
| Visiting relatives and friends | 29.4 | 40.4 | 19.8 | 8.0 | 2.4 |
| Going on trips and holidays | 12.4 | 38.3 | 26.9 | 16.2 | 6.0 |
| Spending leisure time | 23.6 | 48.6 | 19.6 | 6.5 | 1.8 |
| Meeting other people | 21.1 | 48.6 | 22.9 | 6.7 | 0.7 |
| Living life the way they want | 22.4 | 51.3 | 21.1 | 4.2 | 0.9 |
| FOLLOW-UP (n=748) | | | | | |
| Visiting relatives and friends | 18.7 | 41.9 | 26.5 | 9.9 | 2.9 |
| Going on trips and holidays | 12.4 | 35.9 | 24.5 | 21.8 | 5.4 |
| Spending leisure time | 19.1 | 48.7 | 22.4 | 8.2 | 1.6 |
| Meeting other people | 19.3 | 51.8 | 22.0 | 5.9 | 1.1 |
| Living life the way they want | 20.6 | 48.7 | 24.9 | 5.6 | 0.3 |

TABLE 3. Autonomy in participation outdoors scores by tertiles of perceived environmental barriers over the two-year follow-up period among those with complete data at baseline and follow-up (n=748).

| Perceived environmental barriers, number | Baseline | | 2-year follow-up | | Average change % | | | group*time interaction ² | | |
|--|----------|-----|------------------|-----|------------------|------|----------------------|-------------------------------------|------|----------------------|
| | Mean | SD | Mean | SD | % | s.e. | P value ¹ | β | s.e. | P value ² |
| 0 | 4.8 | 3.5 | 5.1 | 3.6 | 6.8 | 4.4 | .121 | ref. | | ref. |
| 1 | 5.9 | 3.5 | 6.6 | 3.3 | 13.3 | 5.1 | .009 | .454 | .346 | .190 |
| ≥ 2 | 6.8 | 3.7 | 7.8 | 4.0 | 14.2 | 3.0 | <.001 | .626 | .280 | .026 |

¹ Wald test

² GEE-model, group*time interaction adjusted for age, gender, cognitive functioning, number of chronic conditions, education and change in walking difficulty. The group*time interaction term tested represents the difference in time-related change in autonomy in participation outdoors between the tertiles of environmental barriers using those without environmental barriers as a reference group.

β = sample estimate of GEE regression coefficient

Note:

Higher scores in autonomy in participation outdoors indicate more restricted sense of autonomy (range 0-20).

SD=Standard Deviation

s.e.= Standard Error

