Perceived Environmental Barriers to Outdoor Mobility and Feelings of Loneliness Among Community-Dwelling Older People.

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Perceived environmental barriers to outdoor mobility and feelings of loneliness among community-dwelling older people

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Running Head: Environmental barriers and loneliness

ABSTRACT

Background: We examined the association between perceived environmental barriers to outdoor mobility and loneliness among community-dwelling older people. In addition, we studied whether walking difficulties and autonomy in participation outdoors affected this association.

Methods: Cross-sectional analyses of face-to-face home interview data with 848 people aged 75-90 years (mean age 80.1 years; 62% women) gathered within the "Life-Space Mobility in Old Age" (LISPE) project. Self-reports of loneliness, environmental barriers to outdoor mobility and difficulties in walking 2 km were obtained with structured questionnaires. Autonomy in participation outdoors was assessed with the 'Impact on Participation and Autonomy' questionnaire.

Results: Altogether, 28% of participants reported experiencing loneliness sometimes or often. These participants also reported more difficulties in walking 2 km, restricted autonomy in participation outdoors and more environmental barriers to outdoor mobility than people not experiencing loneliness. Snowy and icy winter conditions (OR 1.59, 95% CI [1.15-2.20]), long distances to services (OR 1.57, [1.00-2.46]), and hills in the nearby environment (OR 1.49, [1.05-2.12]), significantly increased the odds for loneliness, even after adjustments for walking difficulties, autonomy in participation outdoors, perceived financial situation, living alone and health. Path modeling revealed that environmental barriers increased loneliness either through direct association or indirectly through restricted autonomy in participation outdoors.

Conclusions: Prospective studies should investigate whether removing environmental barriers to outdoor mobility improves autonomy in participation outdoors and alleviates loneliness among older people.

INTRODUCTION

To cope with the demands posed by the outdoor environment requires adequate physical functioning and ability, and thus outdoor mobility is the everyday activity that older people most commonly report restriction (1, 2). Participation restriction refers to "problems an individual may experience in involvement in life situations" (3). Perceived participation refers to the personal context, valuation and needs of the individual and describes the subjective experience of having a free choice in how to live and the possibility to engage in desired activities, thus reflecting the principles of autonomy (4).

Physical features of the environment may be decisive for older people's possibility to participate in out-of-home activities (2), and thus impact their opportunities for socialization. For example, street conditions, traffic, and distance to services are important determinants of outdoor mobility (5-7), while weather conditions also affect older people's willingness and possibilities to move outdoors (8). Challenging outdoor environments may be a threat, particularly for those with walking difficulties (9), as their ability to meet the environmental challenges is lower (10). Although previous studies have shown that environmental barriers can lead to mobility decline (11, 12), restrict participation to out-of-home activities (2) and affect quality of life negatively (13), all of which are associated with loneliness (14, 15), the association between environmental barriers outdoors and loneliness remains unclear.

Loneliness in old age is common and increases risk for depression, physical inactivity, functional decline and mortality (16, 17), and is thus a major public health concern. Loneliness refers to lack of satisfying relationships, indicating emotional isolation, and thus is distinguishable from the concept of social isolation (16, 18). Social isolation refers to lack of

social contacts, which can be objectively measured, for example, as the frequency of meeting people, whereas loneliness is a self-perception (18). This means that an individual can feel lonely even when socially active. Consequently, when investigating loneliness, the interest is in the individual's satisfaction with, rather than frequency of, social contacts and perceived possibilities to participate in social life of interest (18).

The known correlates of loneliness in old age include female sex, living alone, and having poor functional ability (16, 19, 20). Negative life-events, such as declining health or loss of spouse, and a reduced level of social activity increase feelings of loneliness (15). Moreover, it has been suggested that environmental factors that affect opportunities for socialization outside the home, should be taken into account when studying the factors leading to loneliness in old age (21). However, research on loneliness has tended to focus on individual rather than environmental factors, despite knowledge that individual well-being is founded on person-environment interaction (10, 22). Intuitively, environmental factors that restrict participation in out-of-home activities could be associated with social isolation, but it is not clear whether environmental factors are associated with loneliness.

In the present study, we hypothesized that environmental barriers outdoors are associated with loneliness in old age by restricting autonomy in participation in outdoor activities. We also expected that walking difficulties may play a role in the association between environmental barriers and loneliness, as it is known that people with walking difficulties perceive their environment as more challenging (9, 23) and report more feelings of loneliness (24) than people without walking difficulties. Thus, the purpose of the present study was to describe loneliness among community-dwelling older people and to examine its association

with perceived environmental barriers to outdoor mobility. In addition, we studied whether walking difficulties and autonomy in participation outdoors play a role in this association.

METHODS

Study design and participants

Baseline data from the prospective cohort study entitled "Life-space mobility in old age" (LISPE) was used for the cross-sectional analyses. The study design, methods and non-response analyses have been described in detail previously (25).

The target population comprised all community-dwelling 75-to 90-year-old residents of the municipalities of Jyväskylä and Muurame, Finland. A random sample of 2,550 people was drawn from the national population register and potential participants were screened for inclusion via telephone interview. Inclusion criteria were living independently in the community, no severe communication problems, and willingness to participate. A total of 848 people met the criteria, agreed to participate and were interviewed in their homes. The LISPE project was approved by the Ethical Committee of the University of Jyväskylä, Finland. Participants were informed about the project and signed a consent form.

Measurements

Loneliness

Loneliness was captured by asking whether the person feels lonely. Response options were 1) seldom or never, 2) sometimes, and 3) often. For the analyses, loneliness was dichotomized as 1) seldom or never and 2) sometimes or often.

Perceived environmental barriers to outdoor mobility

Perceived barriers in the outdoor environment were assessed using the "Checklist for perceived environmental barriers to outdoor mobility" (PENBOM), which is a 15-item questionnaire on designed to identify environmental barriers that people perceive as hindering their possibilities for outdoor mobility. The PENBOM was developed for the LISPE project, in collaboration between the Gerontology Research Center at the University of Jyväskylä and the Centre for Ageing and Supportive Environments (CASE) at Lund University Sweden. We utilized questions from an earlier study (12), and developed them further. Using the PENBOM, participants were asked whether certain environmental features hindered their possibilities for moving outdoors (yes or no). Perceived environmental barriers for outdoor mobility included poor street conditions, high curbs, hills in nearby environment, long distance to services, lack of benches, lack of benches in winter, noisy environment, busy traffic, dangerous crossroads, cyclists on walkways, snow and ice, insecurity due to other pedestrians, cars or services vans on walkways, poor lighting, and lack of pedestrian zones. The internal consistency of the checklist was acceptable (Cronbach alpha =.716). In the analyses, the environmental barriers constituted 15 separate variables. In addition, the sum of the environmental barriers identified as present (yes) was calculated and then categorized as zero, one or multiple barriers (two or more).

Perceived walking difficulty

Perceived difficulty in walking 2 km was studied using a standardized questionnaire. The participant was asked whether she /he had difficulties in walking 2 km. For the analyses the response alternatives were dichotomized as "no difficulties" (able to manage without difficulty) and "difficulties" (able to manage with some difficulty; able to manage with great

deal of difficulty; able to manage only with the help of another person; unable to manage even with help).

Autonomy in participation outdoors

To study autonomy in participation outdoors, the domain "autonomy outdoors" of the Impact on Participation and Autonomy questionnaire (4, 26) was used. Participants were asked to rate perceived chances in 1) visiting relatives and friends, 2) making trips and traveling, 3) spending leisure time, 4) meeting other people, 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.

Covariates

Socio-economic indicators were self-reports of financial situation (good or very good, moderate, bad or very bad) and years of education. Participants were asked whether they lived alone or with someone else (a spouse, children, grandchildren, siblings or other relatives). The self-reported number of chronic conditions was calculated from a 22-item list and an additional open-ended question about any other physician-diagnosed chronic conditions. The relevance of diseases reported in the open question was confirmed by a physician (25).

Statistical analyses

Participants' baseline characteristics are described using means and standard deviations or percentages. Differences between those reporting feeling/not feeling loneliness were tested with the Chi Square (X^2) or t-test. The associations between the number of and item-specific

environmental barriers and loneliness were first tested with the X^2-test. Thereafter, logistic regression analyses were computed for the number of environmental barriers and for the specific environmental barriers that showed a statistically significant association with loneliness. Because loneliness was more prevalent among women and among those living alone, we tested interactions for the number of environmental barriers×sex (p=.113) and number of environmental barriers×living alone (p=.859) on loneliness. Since these interactions were non-significant, no separate models were created and the models were adjusted for sex and living alone. First, the bivariate associations were adjusted for age and sex. Second, walking difficulty, and third, autonomy in participation outdoors were added to further adjust the bivariate associations. Finally, walking difficulty, autonomy in participation outdoors, and the covariates -perceived financial situation, living alone, and number of chronic conditions - were added to the models. When $p<.05$ or the 95% confidence intervals (CIs) did not include 1, the results were regarded as statistically significant. The IBM SPSS statistics version 20.0 (SPSS Inc., Chicago, IL) was used for these analyses.

A path analysis model, which is one of the techniques included in structural equation methods using LISREL (27) was used for the analyses of the associations between number of environmental barriers, autonomy in participation outdoors and walking difficulties with loneliness. Path analysis makes it possible to study simultaneous associations of the factors that influence loneliness as well as their interrelations. The model fit indicators were χ^2, goodness-of-fit index (GFI) (≥ 0.9 indicates a good fit), and root mean square residual (RMR).The multivariate procedure was accomplished using LISREL 8.72 (Scientific Software International, Inc., Lincolnwood, IL).

RESULTS

Participants' mean age was 80.1±4.3 years and 62% were women. For one individual, data on loneliness was missing, reducing the sample to 847. Overall, 28% of the participants experienced loneliness. Participant characteristics according to loneliness are shown in Table 1. Higher age, restricted autonomy in participation outdoors, chronic conditions, female sex, living alone, walking difficulties and poor or moderate financial situation were associated with loneliness.

Participants who experienced loneliness reported more environmental barriers to outdoor mobility than those who did not report experiencing loneliness ($p<.001$). Eleven of the fifteen specific environmental barriers were more frequently reported by those experiencing loneliness. No differences emerged for poor lighting, cars or service vans on walkways, insecurity due to other pedestrians and lack of pedestrian zones (Table 2).

Reporting one environmental barrier compared to reporting none almost doubled the likelihood of reporting loneliness, while those reporting multiple environmental barriers had a more than two-fold likelihood of loneliness compared to those reporting none (Table 3). Almost half of the specific environmental barriers (snow and ice during winter time, long distances to services, lack of resting places, dangerous crossroads, hills in the nearby environment, noisy traffic, high curbs) significantly increased the odds for experiencing loneliness when adjusted for age and sex (model 1). Walking difficulties had only a minor effect on the associations (model 2), while restricted autonomy in participation outdoors partially explained the associations between environmental barriers and loneliness (model 3). Additional adjustments for living alone, perceived financial situation, and number of chronic conditions did not materially change these findings. The overall number of environmental

barriers as well as the some specific environmental barriers (snow and ice, hills in the nearby environment and long distances to everyday services) remained statistically significantly associated with loneliness (fully adjusted model not shown).

The path analysis model fitted perfectly to the data (χ^2 (1)=.39, p=.53, GFI=1.00, RMR=.005). By adding the number of environmental barriers, autonomy in participation outdoors and walking difficulties into the path model, 11% of the variation in loneliness was explained. Details are shown in Figure 1. Environmental barriers had a direct effect on loneliness, but also an indirect effect through autonomy in participation outdoors was found β =.06 (.01). The more barriers a person perceived in the environment, the more restrictions in autonomy in participation outdoors and the more feelings of loneliness he/she had. Indirect associations were also found between environmental barriers and autonomy in participation outdoors through walking difficulty (β=.17 (.02)) and between walking difficulty and loneliness through autonomy in participation outdoors (β=.09 (.02)). (Indirect associations not shown in the Figure.)

DISCUSSION

The present study shows that perceived environmental barriers to outdoor mobility are associated with feelings of loneliness among community-dwelling older people. It is noteworthy that physical environmental barriers to outdoor mobility not only had a direct effect on loneliness, but also an indirect effect through restricted autonomy in participation outdoors, whereas walking difficulties played only minor role in the association. In particular,

snow and ice, hills in the nearby environment and long distances to everyday services increased the odds for loneliness, even after adjusting for several potential confounders.

Although no previous study has targeted the association between environmental barriers to outdoor mobility and feelings of loneliness, previous research has found associations between environmental factors and physical activity (28, 29), mobility limitations (11, 12, 30) and quality of life (13, 29). Intuitively, mobility difficulties could explain the association between the environmental barriers and loneliness, as people with mobility limitations are more vulnerable to environmental barriers and have increased risk of loneliness (9,24). However, even after adjusting our models for walking difficulties and chronic conditions, the association between environmental barriers and loneliness remained significant, which suggest that other resources e.g. psychological characteristics, in particular self-efficacy, may explain the association (31). Among other things, self-efficacy relates to how much stress a person is experiencing in coping with environmental demands (32), while it also predicts loneliness (33). People with weak self-efficacy invest less effort in the tasks they are doing and thus may feel powerless not only when encountering environmental challenges, but also when experiencing feelings of loneliness. However, such dynamics remain to be investigated in a longitudinal study.

Certain environmental features, such as hills, long distances and weather conditions may restrict older people's ability to perform everyday activities, such as running errands themselves, or to participate in out-of-home activities, and thereby also their possibility to meet other people. In Nordic countries in winter time, especially, people more often stay indoors because of snow and ice (8) and maintenance of social relationships is more difficult, which may restrict autonomy in participation outdoors and increase feelings of loneliness. It

should be noted, however, that for some countries it is hot summer, rather than icy and snowy winter conditions that restrict participation in out-of-home activities. However, seasonal changes would prove an interesting target for research (34).

Differentiating the reasons for and consequences of loneliness is not a straightforward issue, and its dynamics cannot be adequately explored by a single study. People who have feelings of loneliness may perceive their environment as more challenging, but in the reverse direction, a challenging environment may increase feelings of loneliness. We found that restricted autonomy in participation outdoors is associated with loneliness. Earlier studies have predominantly studied the frequency of participation in out-of-home activities, which is distinct from the autonomy (35,36). On the other hand, loneliness may restrict the sense of autonomy in participation outdoors. Feelings of loneliness may also be transitional; for example, a negative life event such as widowhood may temporarily increase feelings of loneliness (15), and also adversely affect autonomy in participation outdoors; however, as the person adapts to the new situation these feelings may diminish. Transitions in feelings of loneliness warrant further study.

The strengths of the present study are that the topic has been little researched, and that we had a good quality data with very few missing data in a large population-based sample of community-dwelling older people. Nevertheless, the study has its limitations. First, the participants were mostly resident in an urban area (94.1%) in Finland. Some studies have indicated that those living in rural areas are likely to be more socially isolated, which may predispose them to loneliness (37). However, due to the very low proportion of people living in rural areas (5.9% of the population), the differences between urban and rural inhabitants remain unclarified. Second, environmental barriers and the prevalence of loneliness in central

Finland might differ from the situation elsewhere in Europe. However, a recent study in Israel with a population similar to ours in age and functional capacity (38) also reported a similar prevalence of loneliness, thus supporting our findings. Third, it should be noted that although the cross-sectional study design with the use of path analyses made it possible to study the direction of the associations, longitudinal studies are needed to confirm the causality of the association.

Conclusion

The findings of the present study suggest that person-environment misfit may lead to loneliness among older community-dwelling people. Prospective studies should investigate whether removing environmental barriers to outdoor mobility improves autonomy in participation outdoors and alleviates loneliness among older people.

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Table 1. Participant characteristics according to loneliness among community-dwelling people aged 75-90 years (N=847).

	Loneliness		
	Yes	No	
	Mean (SD)	Mean (SD)	*P**
Age, years	81.2 (4.29)	79.7 (4.24)	<.001
Education, years	9.6 (3.8)	9.6 (4.3)	.958
MMSE, score	26.0 (2.9)	26.2 (2.7)	.232
Number of chronic conditions	4.9 (2.5)	4.2 (2.4)	<.001
Autonomy in participation outdoors, score	7.4 (4.1)	5.7 (3.5)	<.001
	%	%	
Women	74.2	57.3	<.001
Living alone	78.4	43.6	<.001
Difficulty in walking 2 km	51.3	38.3	.001
Perceived financial situation			.025
Good or very good	43.8	53.1	
Moderate	52.8	45.2	
Poor or very poor	3.4	1.6	

* P-value, Chi Square and t-tests

SD, Standard Deviation

OR, Odds Ratio.

CI, Confidence Interval

MMSE, Mini-Mental State Examination

Table 2.Perceived environmental barriers to outdoor mobility associated with loneliness among community-dwelling people aged 75-90 years (n=847).

Perceived environmental barrier outdoors	Loneliness		P-value *
	Yes	No	
	n=236	n=611	
	%	%	
Number of barriers			<.001
No barriers	19.5	37.3	
One barrier	21.6	20.6	
Multiple (≥2) barriers	58.9	42.1	
Poor street conditions	23.3	17.0	.036
High curbs	12.3	5.7	.001
Hills in nearby environment	32.6	20.3	<.001
Long distances to services	17.8	9.5	.001
Lack of benches	22.5	13.1	.001
Lack of benches in winter	23.7	16.9	.022
Noisy environment	6.4	2.8	.014
Busy traffic	11.4	7.2	.046
Dangerous crossroads	13.1	7.7	.014
Cyclists on walkways	24.2	16.9	.015
Snow and ice	64.8	48.8	<.001
Insecurity due to other pedestrians	6.8	4.9	.282
Vehicles on walkways	2.5	1.3	.207

Poor lighting	4.2	2.9	.346
Lack of pedestrian zones	3.4	3.1	.835

* Chi Square

Table 3. Perceived environmental barriers to outdoor mobility associated with loneliness in logistic regression analyses among community-dwelling people aged 75-90 years (n=847).

Perceived environmental barrier outdoors	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Number of barriers						
No barriers	1.00		1.00		1.00	
One barrier	1.89	1.19-2.99	1.85	1.16-2.94	1.77	1.1-2.8
Multiple barriers (≥2)	2.30	1.56-3.38	2.22	1.49-3.30	1.99	1.3-3.0
Poor street condition	1.36	0.94-1.99	1.31	0.90-1.92	1.25	0.86-1.85
High curbs	1.86	1.09-3.17	1.72	1.00-2.96	1.45	0.84-2.52
Hills in nearby environment	1.66	1.18-2.34	1.59	1.12-2.26	1.49	1.05-2.12
Long distance to services	1.79	1.16-2.79	1.70	1.08-2.66	1.57	1.00-2.46
Lack of benches	1.61	1.08-2.39	1.51	1.01-2.23	1.38	0.92-2.07
Lack of benches in winter	1.25	0.85-1.82	1.17	0.80-1.72	1.11	0.76-1.64
Noisy environment	2.18	1.05-4.51	2.15	1.04-4.47	1.98	0.94-4.17
Busy traffic	1.52	0.90-2.54	1.46	0.87-2.45	1.35	0.79-2.29
Dangerous crossroads	1.73	1.06-2.82	1.68	1.03-2.75	1.62	0.98-2.67
Cyclists on walkways	1.44	0.99-2.09	1.43	0.99-2.09	1.36	0.93-2.00
Snow and ice	1.77	1.29-2.44	1.71	1.23-2.37	1.59	1.15-2.20

Model 1: bivariate associations, adjusted for age and sex.

Model 2: bivariate associations, adjusted for age, sex, and walking difficulties.

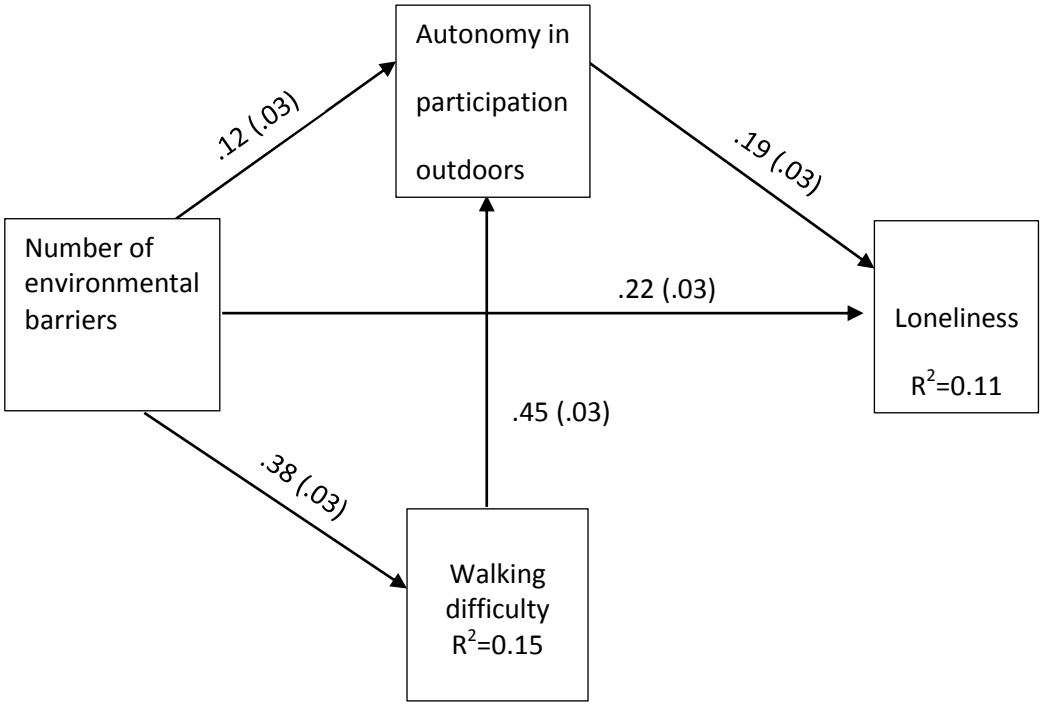
Model 3: bivariate associations, adjusted for age, sex, and autonomy in participation outdoors.

Figure legends

Figure 1. The path analyses model of the relationships between number of barriers in the outdoor environment, autonomy in participation outdoors, walking difficulties and loneliness among 75- to 81-year-old community-dwelling people (N=847).

NOTE: Arrows indicate significant associations and their directions between variables. Coefficients are significant if they are greater than twice the standard error (in parenthesis). The R^2 values indicate the amount of variation in the dependent variables explained by the other shown variables.

Figure 1.


Autonomy in participation outdoors
.12 (.03)
.19 (.03)
Number of environmental barriers
.22 (.03)
Loneliness
R^2=0.11
.45 (.03)
.38 (.03)
Walking difficulty
R^2=0.15