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Availability and use of neighborhood resources by older people with osteoarthritis: Results from the European Project on OSteoArthritis

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ABSTRACT

This study examines the availability and use of neighborhood resources in relation to clinical lower limb osteoarthritis (LLOA) in older participants from six European countries. Of the 2757 participants (65–85 years), 22.7% had LLOA. Participants with LLOA made more use of places to sit (OR=2.50; CI: 1.36–4.60 in the UK), and less use of parks and walking areas (OR=0.30; CI: 0.12–0.75 in Sweden), compared to participants without LLOA, particularly in countries with high availability of resources. The results suggest that specific features of the environment impact the use of neighborhood resources by older adults with LLOA.

1. Introduction

A growing body of research suggests that features of the physical environment, such as public facilities and public transportation, are linked to physical and social activities in older adults (Giles Corti and Donovan, 2002; Leslie et al., 2007; Owen, et al., 2004; Wennberg et al., 2009). An optimal physical environment is considered to offer support for activity and participation and to contribute to quality of life in old age (Ståhl et al., 2008; Rantakokko et al., 2010; Banister and Bowling, 2004). However, pain and disability caused by a chronic condition may give rise to a less than optimal use of the environment. According to the Global Burden of Disease 2010 study, musculoskeletal conditions, among which osteoarthritis (OA), are the second greatest cause of disability worldwide (Vos et al., 2012). OA of the lower limbs (hips and/or knees) is associated with significant pain and disability in older adults (Peat et al., 2001; Brooks, 2002). Lower limb OA (LLOA) accounts for more disability, involving lower extremity functions, such as walking and climbing stairs, than other diseases (Guccione et al., 1994). The present study aims to examine the availability and use of the neighborhood environment in relation to clinical LLOA, based on data from the European Project on OSteoArthritis (EPOSA), in six European countries, which are Germany, the Netherlands, Spain, Sweden and the United Kingdom (UK) (Van der Pas et al., 2013).

The role of environment in ageing is grounded in literature regarding the ecology of aging and environmental gerontology to which Lawton and others have made major contributions (Wahl et al., 2012; Wahl and Weisman, 2003). Theories from environmental gerontology and World Health Organization's International Classification of Functioning, Disability and Health suggest that environmental factors can facilitate or impede older adults functioning in terms of activities or participation (Clarke and

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Nieuwenhuijsen, 2009; Lawton and Nahemow, 1973). For example, Lawton's person environment (P–E) fit model (Lawton and Nahemow, 1973; Scheidt and Norris-Baker, 2004) suggests that human behavior is influenced by the interaction between individual competence (capacity) and the demands of the social and physical environment. Derived from this model, the environmental docility hypothesis (Lawton, 1986) suggests that the less competent the individual, the greater the impact of environmental factors on that individual. When the personal and environmental components are matched, adaptation is achieved. Older people with OA may have lower competence than those without the condition, and may therefore be more vulnerable to environment demands (Iwarsson and Ståhl, 2003). A response to functional loss in later life will require either reduction of demands from the environment or increased usage of resources from that environment. The present study is focused on the P–E fit in terms of older people with OA (personal component), the neighborhood environment (environment component), and use of neighborhood resources (adaptation level). For example, outdoor walking is important for older people to run errands, take part in recreational activities, and participate in community life and social events (Eronen et al., 2014). In the case of neighborhood environment, the person–environment relationship is conditional on the actual availability of resources in the environment (Iwarsson and Ståhl, 2003; Hovbrandt et al., 2007; Wennberg et al., 2009).

Previous research examining the importance of neighborhood resources and transportation in the lives of older people has been conducted in the area of urban public transport (Carlsson, 2004; Risser et al., 2010), the use of the pedestrian environment (Hovbrandt et al., 2007; Ståhl et al., 2008; Wennberg et al., 2009), the neighborhood environment at nursing homes (Bengtsson and Carlsson, 2005), impact on physical activity (Van Cauwenberg et al., 2011; Humpel et al., 2002) and participation (Booth et al., 2000; Leyden, 2003). Environmental barriers recognized in these studies were lack of benches, lack of or too high curb cuts or curbs, bad lighting and uneven, narrow pathways/sidewalks as well as bikes on pavements, heavy traffic and inaccessible bus stops (Carlsson, 2004; Hovbrandt et al., 2007; Ståhl et al., 2008; Wennberg et al., 2009). Relevant environmental facilitators recognized in these studies were accessibility, social support, neighborhood safety and aesthetic attributes (Humpel et al., 2002; Booth et al., 2000). Furthermore, studies have shown that environmental barriers have a greater impact on older people with functional limitations than older persons without functional limitations (Hovbrandt et al., 2007; Shumway-Cook et al., 2003).

Only few studies have examined the availability and use of neighborhood resources for older adults with osteoarthritis. In a qualitative study using focus groups of older adults with arthritis on the use of community resources for OA self-management, environmental characteristics (e.g., sidewalk conditions, curb-cuts, handicapped parking, automatic doors) both facilitated and hindered use of community resources (Martin et al., 2011). A quantitative study on community dwelling older adults with symptomatic knee OA, showed that people with functional limitations encountering community mobility barriers are more limited in their daily activities but do not perform these daily activities any less frequently (Keysor et al., 2010). Parks and walking areas, handicapped parking, and public transportation were important features of the neighborhood environment facilitating mobility for older adults with existing functional limitations due to knee-osteoarthritis (White et al., 2010; Keysor et al., 2010). However, these studies focused on regions within the United States of America, resulting in limited understanding of varying patterns of availability and use of the neighborhood environment in different regional actualities. Previous research has shown that neighborhood resources are distributed differently between European countries and also urban and more rural regions within these countries (Mollenkopf et al., 2004).

The current population-based study extends previous research by including a large sample of older persons without OA as well as older people with OA, across six European countries. So far, the impact of the availability and use of neighbourhood resources has never been studied on older persons with OA within different environments such as found across Europe. To support activity and promote participation of people with OA more knowledge is needed about the features of neighborhood environments that are available and which of these features are being utilized by this population. Moreover, population-based studies such as this current study are important as they provide information on the burden of OA in terms of quality of life and health status, thus offering future direction for community planning and prevention strategies.

The first objective of the current study is to describe the availability of neighborhood resources within six European countries. The second objective is to examine the association between LLOA and use of neighborhood resources within each country.

2. Methods

2.1. Design and study sample

Baseline data from the EPOSA study were used, which focuses on the personal and societal burden and its determinants of OA in older persons. A detailed description of the study design and data collection of the EPOSA study is described elsewhere (Van der Pas et al., 2013). In summary, random samples were taken from existing population-based cohorts in six European countries (Germany, the Netherlands, Spain, Sweden and the UK). In Italy, a new sample was drawn. A total of 2942 respondents (response rate, ranging from 64.6% to 82.2%, averaging 72.8%) were included. The age-range was between 65–85 years in most countries except for the UK, which had an age-range of 71–79 years. All participants were interviewed by a trained researcher at home (in the Netherlands, Sweden and the UK) or in a clinical center (in Germany, Italy and Spain), using a standardized questionnaire and a clinical exam. The interview lasted about one and a half hours. For all six countries, the study design and procedures were approved by the Medical Ethics committee of the respective centers.

In the current study, data on LLOA and availability of the neighborhood environment were available for 2869 (98%) participants. Excluded participants due to missing data on these variables ($n=73$) were older, more often female, lower educated and had more chronic diseases.

2.2. Measures

2.2.1. Lower limb OA

Algorithms for clinical OA of the hip and knee were developed based on the classification criteria developed by the American College of Rheumatology (Altman, 1991). The diagnosis of clinical hip OA was based on both self-report and physical examination: pain in the hip was evaluated by the Western Ontario and McMaster Universities OA Index (WOMAC) pain subscale score (cutoff score = 3, range 0–20), plus all of: pain associated with hip internal rotation in at least one side; morning stiffness lasting <60 min evaluated by the WOMAC stiffness subscale (score from 'mild' to 'extreme'); and over 50 years of age (Bellamy, 2009). The diagnosis of clinical knee OA was based on both self-report and physical examination: pain in the knee was evaluated by the WOMAC pain subscale score (cutoff score = 3, range 0–20), plus any 3 of: over 50 years of age, morning stiffness lasting <30 min

evaluated by the WOMAC stiffness subscale (score from 'mild' to 'extreme'); crepitus on active motion in at least one side; bony tenderness in at least one side; bony enlargement in at least one side, no palpable warmth of synovium in both knees. LLOA was defined as present when the participant had clinical OA in hip and/or knee.

2.2.2. Neighborhood resources

The availability and use of neighborhood resources was assessed using a modified version of the Home and Community Environment (HACE) instrument (Keysor et al., 2005). The HACE is a standardized, self-report instrument designed to assess factors in a person's environment that may influence level of participation. The modified version included items pertaining to community mobility and transportation which have shown to be important features of the neighborhood environment for older adults with functional limitations (Keysor et al., 2010; White et al., 2010). The availability of neighborhood resources was assessed by asking the participants: "Could you please indicate if any of the following facilities can be found in your neighborhood?" (1) parks and walking areas that are easy to get to and easy to use; (2) places to sit and rest at bus stops, in parks, or in other places where people walk; (3) public transportation close to home. Response categories were 'a lot', 'some' and 'not at all'. Each item was scored to reflect whether the resource was available. Responses 'a lot' and 'some' were coded to 1 and 'not at all' was coded to 0. The dichotomization has been applied in previous studies (Keysor et al., 2010; White et al., 2010). Use of neighborhood resources was assessed by asking those participants who indicated resources were available:"Do you make use of these facilities?" (0= no, 1= yes). In addition, participants were asked if they drive a car (1=no, 2=yes).

2.2.3. Potential effect modifiers

Potential effect modifiers were country of residence and the level of urbanization. Level of urbanization was assessed based on population size and density (1=rural, <300 persons/km^2 or <5000 inhabitants; 2= intermediate, 5000–30000 inhabitants; 3=urban, >300 persons/km^2 and >5000 inhabitants.

2.2.4. Potential confounders

Potential confounders included age, gender, partner status, educational level, level of physical activity, number of chronic diseases, symptoms of anxiety and depression, and functional limitations, which were previously found to be associated with the use of neighborhood environment and OA (Mollenkopf et al., 2004; Wilkie et al., 2007). Partner status was assessed by asking what the marital status was of the participant. The data were categorized into having no partner (including being single/never married, divorced and widowed) versus having a partner (including being married or cohabiting, registered partnership and living apart together). Level of education was assessed by asking for the highest level of education the participant had completed and was categorized into elementary school not completed, elementary school completed, vocational education or general secondary education, and college or university education. The level of physical activity was measured using the validated LASA Physical Activity Questionnaire (Stel et al., 2004), which estimates the frequency and duration of participation in activities (walking, bicycling, gardening, light and heavy household tasks and sports activities) in the previous two weeks, resulting in a total physical activity time in minutes per week. Number of chronic diseases was assessed by asking the participants whether they had any of the following diseases or symptoms that lasted for at least three months or for which the participant had been treated or followed by physician: chronic non-specific lung disease, cardio-vascular diseases, peripheral arterial disease, diabetes mellitus, stroke, cancer and osteoporosis. Weight and height were both objectively measured by a trained researcher during the interview. BMI was calculated as weight in kilograms divided by height in square meters. Anxiety and depressive symptoms were examined by the Hospital Anxiety Depression Scales (HADS) (Zigmond and Snaith, 1983). The HADS is a self-report questionnaire comprising 14 four-point Likert scaled items, 7 for anxiety (HADS-A) and 7 for depression (HADS-D). Both scales have a range from 0 to 21. A higher score on the HADS-A and HADS-D indicates greater anxiety and depression respectively. To assess the severity of OA, functional limitations were assessed by the physical function subscales of the WOMAC. The physical function subscale contains seventeen items relating to difficulty with knee and/or hip function experienced in the previous 48 h. Missing values were imputed according to the user manual, and subscale scores were normalized resulting in subscale scores ranging from 0 (no difficulties) to 100 (extreme difficulties) (Bellamy, 2009). Because of non-normal distribution, the functional limitations scale was categorized into no limitations (0), and land-specific tertiles (tertile 1–3).

2.2.5. Analytical strategy

Baseline demographic and health characteristics are presented using descriptive statistics. Differences in mean were tested using *T*-test for normally distributed variables, difference in median were tested using Mann–Whitney *U* Test for skewed variables, and differences in frequencies were tested using the Pearson Chi-square Test. Descriptive characteristics of the availability of neighborhood resources are provided for older persons by country. The descriptive analyses were weighted. The weights were calculated per sex and per five-year age category, using the formula: W=Nexp/Nobs, with the Nobs being the number of persons in a specific age/sex category in the cohort, and Nexp being the number of persons in a specific age/sex category in the European standard population in 2010 (Eurostat, 2010).

Logistic regression analyses were used to examine the associations between LLOA and use of neighborhood resources. First, it was tested whether there was an interaction effect of the availability of the resources in the association between LLOA and use of resources. Second, country and urbanization level were assessed for potential effect modification by using country*LLOA and urbanization level*LLOA product terms. In case of a significant interaction effect ($p<0.10$), further analyses were stratified on country or urbanization level. In case the interaction effect was not significant, a pooled analysis (adjusted for country/urbanization level) was performed. Third, other potential confounders (as described earlier) were entered into the analyses in the following order: (1) sample characteristics: age, sex, urbanization and country (if no effect modifier), (2) lifestyle characteristics: partner status, educational level, physical activity, (3) physical and mental comorbidity: number of chronic diseases, symptoms of anxiety and depression, and (4) severity of OA: functional limitations.

3. Results

The characteristics of the study sample are reported in Table 1. The prevalence of clinical LLOA was 22.7%. Of the participants with OA, 72.9% had clinical knee OA, 10.7% had clinical hip OA and16.4% had both knee and hip OA. The average age of the participants is 73.8 years old (SD=5.6), 56.5 percent is female, and the majority has a partner (66.5%) and has completed elementary school or less (44.8%). Most of the participants live either in an urban (62.3%) or intermediate (29.6%) area, while only 8.1% live in a rural area. Just over half of the participants experience functional limitations (51.1%). Persons with LLOA were significantly older, more often

Table 1
Characteristics of the study sample, stratified by presence of lower limb OA.

	Total sample ($n=2757$)	LLOA present ($n=2130$)	LLOA not present ($n=627$)	p-Value*
Age, years[a]	73.8 (5.6)	74.3 (5.7)	73.6 (5.6)	0.01
Sex, % women	56.7	71.1	52.4	<0.001
Partner status, % single	33.5	35.7	32.8	0.19
Education level, %				
Elementary school not completed	11.4	16.7	9.8	
Elementary school completed	34.6	40.6	32.9	
Vocational education or general secondary education	33.1	29.3	34.2	
College or university	20.9	13.3	23.1	<0.001
Country of residence, %				
Sweden	18.9	18.3	19.1	
United Kingdom	12.3	9.9	13.0	
The Netherlands	19.8	18.4	20.3	
Germany	13.3	6.9	15.2	
Italy	16.7	25.5	14.2	
Spain	18.9	21.1	18.2	<0.001
Urbanization grade, %				
Rural	8.3	7.8	8.4	
Intermediate	30.2	32.6	29.5	
Urban	61.5	59.6	62.1	0.33
No of chronic diseases[b]	1 [0–2]	1 [1–2]	1 [0–2]	<0.001
Physical activity, min/day[b]	170.7 [100.7–259.6]	170.1 [90.0–249.9]	171.4 [102.9–261.7]	0.04
Anxiety symptoms (HADS-A)[b]	4 [2–7]	6 [3–9]	4 [2–6]	<0.001
Depressive symptoms (HADS-D)[b]	3 [1–5]	4 [2–7]	3 [1–5]	<0.001
Functional limitations (WOMAC)[b]	1.5 [0–11.8]	22.1 [10.3–36.8]	0 [0–4.4]	<0.001
Knee OA only, %	20.3	72.9	–	
Hip OA only, %	6.2	10.7	–	
Knee and hip OA, %	22.7	16.4	–	
Lower limb OA, %	22.7	100.0	–	

LLOA: lower limb osteoarthritis;
[a] Results are presented as mean (SD);
[b] Results are presented as median [interquartile range].
* p-Value of observed differences between groups with and without LLOA.

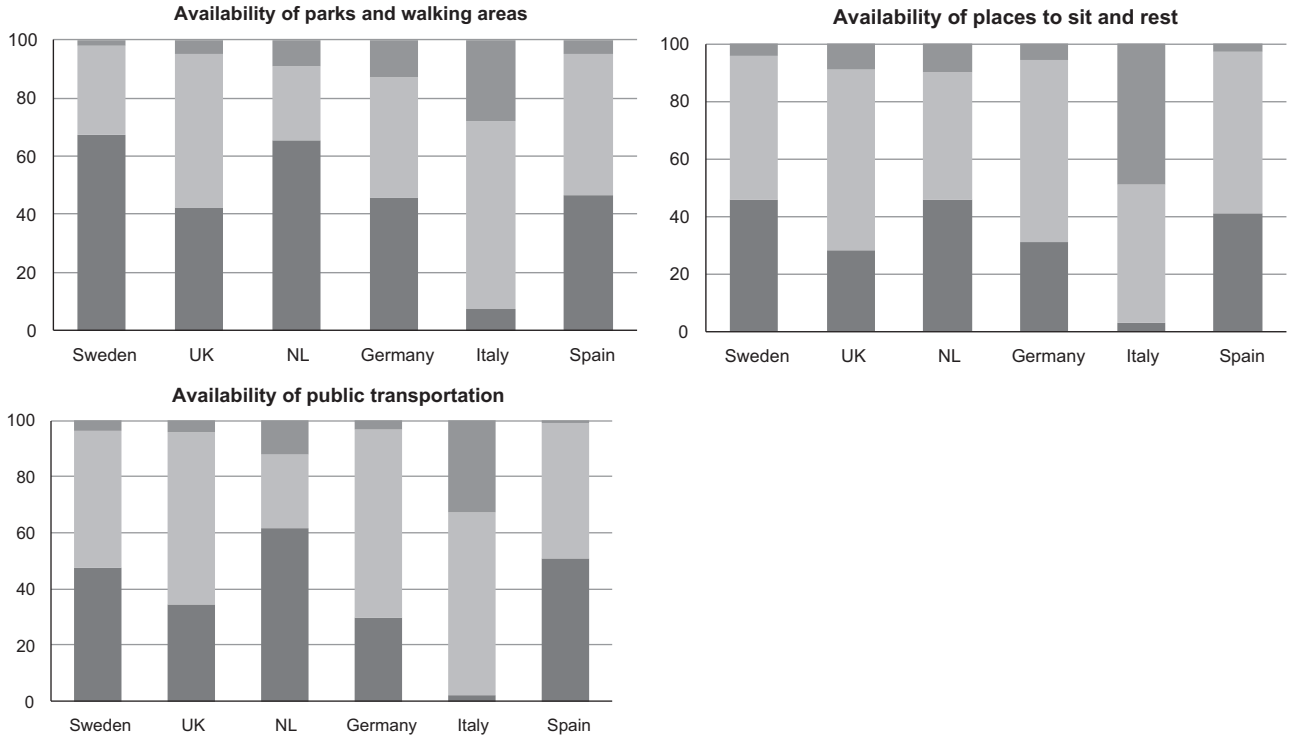

Fig. 1. Availability of three types of resources in the neighborhood in different countries. : A lot; : Some; : Not at all.

Table 2
Use of neighborhood resources across countries in percentages.

	Use of parks and walking areas		Use of places to sit and rest		Use of public transportation		Use of a car	
	LLOA	No LLOA	LLOA	No LLOA	LLOA	No LLOA	LLOA	No LLOA
Sweden	**89.1**	**95.2**	**71.0**	**46.5**	78.3	85.6	**58.2**	**69.8**
UK	62.3	63.8	**62.4**	**38.9**	60.2	50.6	**56.5**	**71.8**
The Netherlands	**58.8**	**74.3**	**54.9**	**37.3**	46.0	50.2	**45.1**	**66.6**
Germany	90.3	91.2	44.4	35.8	69.5	66.5	69.8	80.9
Italy	56.1	56.4	23.2	19.7	11.2	10.4	68.0	74.4
Spain	69.0	73.1	67.6	63.4	82.0	86.3	**18.5**	**42.1**

In **bold:** significant difference between groups with and without LLOA within a country ($p \leq 0.05$)

female, had a lower educational level, had more chronic diseases, were less physically active, had more symptoms of anxiety and depression, and had more functional limitations as compared with persons with no LLOA.

Differences were found between countries in the availability of the neighborhood resources (Fig. 1). Particularly in Italy, the participants have little availability of parks and walking areas, places to sit and rest, and public transport (28.1%, 49.2%, and 32.6% respectively with no availability of these resources). In contrast, the participants in the Netherlands and Sweden have a lot of availability of parks and walking areas (65.7% and 67.4% respectively), and places to sit and rest (both 45.8%). Availability of a lot of public transport is also high for the Netherlands (61.8%), followed by Spain (51.1%) and Sweden (47.4%). No significant interaction effect of availability of resources was found in the association between LLOA and use of resources.

In Table 2, country differences in the use of neighborhood resources are presented. There were significant differences across the countries in the use of parks and walking areas, places to sit and rest, and use of a car, between persons with LLOA and no LLOA. In Sweden and the Netherlands, persons with LLOA made less use of parks and walking areas, more use of places to sit and rest, and less use of the car, than those with no LLOA ($p \leq 0.05$). In the UK, persons with LLOA made more use of places to sit and rest, and less use of a car, than those with no LLOA ($p \leq 0.05$). In Spain, persons with LLOA made less use of the car than those with no LLOA ($p \leq 0.05$).

Because effect modification was found for country in the associations with the four neighborhood resources, the multiple logistic analyses were stratified by country. No effect modification was found for urbanization level. Therefore, this variable was used as a confounder in all analyses. In Table 3, the associations between clinical LLOA and the use of neighborhood resources are presented for each country separately.

Table 3
Associations between lower limb OA and use of neighborhood resources across countries.

	Use of parks and walking areas OR (95% CI)	Use of places to sit and rest OR (95% CI)	Use of public transportation OR (95% CI)	Use of a car OR (95% CI)
Sweden				
Model 1	**0.30 (0.13–0.70)**	**2.27 (1.33–3.89)**	0.55 (0.29–1.06)	0.79 (0.46–1.35)
Model 2	**0.32 (0.13–0.79)**	**2.37 (1.37–4.08)**	0.56 (0.29–1.08)	0.80 (0.47–1.38)
Model 3	**0.30 (0.12–0.75)**	**2.34 (1.35–4.06)**	0.56 (0.29–1.10)	0.82 (0.47–1.42)
Model 4	**0.27 (0.08–0.92)**	1.41 (0.70–2.81)	0.58 (0.24–1.40)	1.31 (0.65–2.65)
UK				
Model 1	0.91 (0.51–1.65)	**2.54 (1.42–4.52)**	1.17 (0.67–2.04)	0.63 (0.34–1.16)
Model 2	1.07 (0.58–1.98)	**2.63 (1.44–4.78)**	1.28 (0.72–2.28)	0.66 (0.35–1.26)
Model 3	1.10 (0.59–2.05)	**2.50 (1.36–4.60)**	1.14 (1.03–1.26)	0.69 (0.36–1.31)
Model 4	1.60 (0.71–3.63)	1.84 (0.88–3.85)	1.10 (0.53–2.27)	0.85 (0.37–1.92)
The Netherlands				
Model 1	**0.54 (0.33–0.89)**	**1.85 (1.15–2.98)**	0.87 (0.54–1.40)	**0.46 (0.28–0.74)**
Model 2	**0.56 (0.34–0.93)**	**1.80 (1.11–2.91)**	0.94 (0.58–1.52)	**0.46 (0.28–0.76)**
Model 3	**0.56 (0.32–0.96)**	1.64 (0.99–2.72)	0.87 (0.53–1.44)	**0.47 (0.28–0.80)**
Model 4	0.88 (0.44–1.77)	1.70 (0.85–3.37)	1.07 (0.54–2.09)	0.67 (0.34–1.31)
Germany				
Model 1	0.49 (0.17–1.44)	1.57 (0.79–3.14)	1.12 (0.54–2.30)	0.59 (0.26–1.35)
Model 2	0.44 (0.15–1.33)	1.41 (0.69–2.86)	1.16 (0.56–2.42)	0.58 (0.25–1.36)
Model 3	0.43 (0.14–1.32)	1.38 (0.67–2.83)	1.11 (0.53–2.32)	0.61 (0.26–1.44)
Model 4	0.48 (0.14–1.57)	0.98 (0.44–2.19)	0.84 (0.38–1.86)	0.75 (0.30–1.87)
Italy				
Model 1	0.98 (0.59–1.64)	1.31 (0.64–2.69)	0.92 (0.38–2.21)	1.06 (0.61–1.86)
Model 2	0.94 (0.56–1.59)	1.23 (0.58–2.59)	0.81 (0.32–2.05)	1.12 (0.63–2.00)
Model 3	1.05 (0.61–1.80)	1.21 (0.56–2.61)	0.71 (0.27–1.89)	1.17 (0.65–2.10)
Model 4	1.32 (0.64–2.71)	1.58 (0.50–5.06)	0.59 (0.18–1.95)	0.59 (0.29–1.22)
Spain				
Model 1	0.77 (0.48–1.24)	1.11 (0.70–1.75)	0.94 (0.52–1.68)	0.74 (0.41–1.33)
Model 2	0.82 (0.51–1.34)	1.10 (0.69–1.75)	1.06 (0.58–1.94)	0.82 (0.45–1.50)
Model 3	0.80 (0.49–1.31)	1.07 (0.67–1.71)	1.07 (0.58–1.99)	0.98 (0.52–1.83)
Model 4	0.87 (0.48–1.56)	0.91 (0.51–1.60)	1.11 (0.54–2.32)	1.26 (0.60–2.62)

Model 1: adjusted for age, sex and urbanization level.
Model 2: additionally adjusted for partner status, education level and physical activity.
Model 3: additionally adjusted for number of chronic diseases, anxiety and depression.
Model 4: additionally adjusted for functional limitations.
OR: odds ratio; CI: confidence interval; in bold: $p < 0.05$.

In Sweden and the Netherlands, participants with LLOA were less likely to make use of parks and walking areas compared to participants without LLOA in model 1 (adjusting for age, sex and urbanization level) (e.g. OR 0.54; 95% CI: 0.33–0.89 in the Netherlands). After adjusting for other confounding factors, the associations changed only slightly. After adjusting for functional limitations, the association is attenuated in Sweden but was no longer significant in The Netherlands. No associations between LLOA and use of parks and walking areas were found in the UK, Germany, Italy and Spain.

In Sweden, the UK, and the Netherlands, participants with LLOA were more likely to make use of places to sit and rest compared to participants without LLOA (e.g. OR 2.54; 95% CI: 1.42–4.52 in model 1 in the UK). Additional adjustment for confounding factors only marginally changed these associations in Sweden and the UK. However, after adjusting for functional limitations, the association was no longer significant. In the Netherlands, after adjusting for number of chronic diseases, and symptoms of anxiety and depression, the association was no longer significant. No associations were found in the other countries.

In the Netherlands, participants with LLOA were less likely to use a car compared to participants without LLOA (Model 1: OR 0.46, 95% CI: 0.28–0.74). After adjusting for other confounding factors, the associations changed only slightly. The association was no longer significant after adjustment for functional limitations. No associations were found in the other countries.

4. Discussion

This study has shown that features of the neighborhood environment both facilitate and hinder the use of the neighborhood environment by older people with LLOA; and that this varies between European countries. Moreover, our study suggests that differences in the use of resources by people with LLOA are more likely to be found in countries where neighborhood resources are more readily available.

People with LLOA in the Netherlands and Sweden make less use of parks and walking areas, while people with LLOA in Sweden and the UK make more use of places to sit and rest, compared to people without LLOA. These associations remained significant after adjustment for demographic, lifestyle and health characteristics. However, after adjustment for functional limitations the associations were no longer significant, and attenuated the association with less use of parks and walking areas in Sweden. Functional limitations was assessed using the WOMAC which focuses specifically on difficulty in physical function with knee and/or hip function (Bellamy, 2009). This suggests that these functional limitations are likely to be important mediators in the association between LLOA and use of neighborhood resources.

In this study we found that there was more availability of parks and walking areas, and places to sit and rest in the Netherlands and Sweden, than in Italy where there was little availability of these resources. In rural areas, which was the case in Italy, natural countryside may not provide sufficient access to older people with disabilities to make use of these areas. These findings are consistent with previous research on the differential distribution of neighborhood resources between European countries and structural conditions of the region (Mollenkopf et al., 2004).

However, the availability of neighborhood resources may not be enough to actually make use of the resources, particularly of parks and walking areas. No significant interaction effect of availability of resources was found in the association between LLOA and use of resources. The use of neighborhood resources may also need to be stimulated. Previous studies have shown that factors such as perceived safety, aesthetic nature of the environment (for example, enjoyable scenery) and convenience (for example hills) are associated with the use of the environment (Humpel et al., 2002). In a study by Sallis et al. (1997), women in rural areas less often reported sidewalks and streetlights, but also lower crime rates, and more safe places to exercise, compared to urban women. Desire and ability of people to participate in an activity are influenced by the distance or travel time to access an activity, and also the importance of the activity to the person (Giles-Corti and Donovan, 2002). Therefore, strategies to ensure the availability of public spaces for disabled people need to be complemented by strategies that aim to influence individual and social environmental factors to enhance the use of neighborhood resources.

Also, in countries where there is more availability of resources, avoidance of specific features by older adults with OA becomes more prominent. Shumway-Cook et al. (2003) suggested that disabled older adults were more likely to avoid specific features (for example busy streets) within an environment that posed a challenge to mobility. However, although disabled older adults desire to avoid certain features in the environment they still may encounter these features during trips into the community.

Strengths of our study were that it is the first large-scale study that examines the availability and use of neighborhood resources in older people with OA in Europe. The current study used a population-based approach, focusing on one disease group. Also, the same measures were used in all countries, including a clinical measurement of OA.

Our study has some limitations. Firstly, as EPOSA was set up as a side study in existing cohort studies (except for the study sample in Italy), there were some differences in recruitment procedures (see design paper for more details (Van der Pas et al., 2013). However, data acquisition was standardized; all questionnaires and examination procedures were similar across centers, and all training for clinical examination was undertaken by one team to minimize differences in clinical examination. Secondly, the selected resources included from the HACE instrument are not exhaustive, and it is possible that certain resources are more important in a specific (cultural) context. For example, handicapped parking was not included in the current study, which has been identified as an important environmental feature for older adults with disabilities (White et al., 2010). Thirdly, no information was included on the satisfaction with engagement in the neighborhood environment, which could shed light on potential ways to improve daily life for older adults with osteoarthritis. Fourthly, availability of the neighborhood environment was measured in terms of whether the resource was available, while the actual proximity of resources may also be important (Martin, et al., 2011). In our study the proximity of the neighborhood resources was not taken into account. Fifthly, residential self-selection (people's choice where to live based on their travel needs and preferences) may have confounded the relationships between people with LLOA and the use of neighborhood resources. Sixthly, people who were excluded due to missing data were older, more often female, lower educated and had more chronic diseases. As a result, the observed associations may be underestimated. Finally, the cross-sectional design makes it impossible to be certain of the causal effect between LLOA and the use of neighborhood resources. It is possible that LLOA causes older adults to make less use of the environment, but it may also be possible that older adults who already made less use of neighborhood resources due to a lack of physical activity are more likely to have LLOA (Blagojevic et al., 2010).

Future research is needed to investigate the causal relationship between LLOA and use of the neighborhood environment. In particular, longitudinal, prospective studies are needed to investigate the impact of a broader range of neighborhood resources on physical and social activity of older people with LLOA. For example, do people with LLOA make more use of the neighborhood

environment because it is available, or because people with LLOA who like to make use of the neighborhood environment choose those neighborhoods conducive to their preference?

In conclusion, this study shows that there is variability in both the availability and use of neighborhood resources by older people with LLOA in the general population in Europe. In particular, neighborhood features such as places to sit and rest, and use of parks and walking areas impact the use of the environment.

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