THE ASSOCIATION BETWEEN PERCEIVED ENVIRONMENTAL BARRIERS AND WALKING ACTIVITY AMONG OLDER ADULTS

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ABSTRACT

With increasing age, people become less physically active, partly due to increased vulnerability to environmental demands. The aim of this study was to investigate the association between perceived barriers in the outdoor environment and walking activity among older adults. These analyses form part of the Screening and Counseling for Physical Activity and Mobility project (SCAMOB). The study design was cross-sectional. The participants were 75-81-year-old, able to walk independently outdoors, not highly physically active and were living in the center of Jyväskylä (N=632, 159 men, 473 women). Walking activity and environmental barriers were assessed with self-reports. An indicator of environmental press was created by calculating the number of barriers. Data were analyzed with chi-square and t-tests and logistic regression analysis. Majority reported having no barriers, women reporting more barriers than men. Among men (OR 3.04, 95% CI 1.09-8.48) not walking outdoors at all was more common among those who reported two or more environmental barriers. Adjustment for self-rated health attenuated the association. In women, a parallel but non-significant association was found. Perceived environmental barriers correlate with limited walking activity among urban community-living ambulatory older adults. Future studies should investigate underlying reasons for gender difference.

Keywords: older people, physical activity, walking, outdoor environment
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1 INTRODUCTION

Promotion of physical activity is important among older people because it provides several benefits for them. It helps to prevent chronic diseases such as diabetes, obesity, hypertension and osteoporosis (Warburton, et al. 2006). Being physically active is associated with reduced risk of depression (Lampinen et al., 2000). Similarly, inactivity is associated with increased risk of depression (Rosqvist et al., 2009). Besides healthy active people, older people with existing health conditions may benefit from physical activity to a great degree. For instance, being physically active reduces risk for mortality and disability (Hirvensalo et al., 2000) and depression (Strawbridge et al., 2002) among older people with existing mobility problems. Despite the well known benefits, older people tend to report declining physical activity levels (Mäkilä et al., 2010) and feeling of not being as physically active as they would want to (Rantakokko et al., 2010).

Walking is a common form of physical activity among older people (Simpson et al., 2003; Mäkilä et al., 2010). It is not expensive and it is easy to do close to home in an urban environment. In addition to being one type of leisure-time physical activity, walking is related to many other functions of everyday life. The ability to walk in one’s environment enables social interaction, running errands and enjoying the outdoors.

The number of older people living in cities is increasing (World Health Organisation, 2007), therefore, the determinants of walking in urban environment need to be studied. According to the ecological model of aging, also known as the competence-press model, physical activity is the result of the adaptation of the individual to the environment, and as a result of declining health older people may be more vulnerable to the environmental press (Lawton & Nahemow, 1973). In this paper, the competence-press model is used as a framework for studying the environmental influence of walking activity in an urban environment, and how the individual’s competence indicated by health status affects the association.
2 THE COMPETENCE-PRESS MODEL

According to the competence-press model introduced by Lawton & Nahemow (1973) behavior is a function of individual’s competence and environmental press. Individual competence can refer to a variety of abilities or qualities of the individual, such as physical health, cognitive abilities or social status. Environmental press refers to the characteristics of the environment, which can be negative or positive, demanding or supportive features, depending on the interaction with the individual competence. Lawton & Nahemow (1973) refer to the objective aspect of the environment. According to the model, a good person-environment fit leads to an adaptive response of the individual. Deviation of the adaptation level in either direction to a certain point results in positive affect. Further deviation leads to tolerable and finally to negative affect. With decreasing competence the optimal adaptation level becomes narrower, and as a result increasing environmental press leads to negative affect more quickly compared with higher competence. According to the docility hypothesis, with declining competence the individual is more controlled by the environment, “the proportion of behavior attributable to environmental, as contrasted with personal, increases” (Lawton & Nahemov 1973, p. 658). Moreover, performance at the higher level of the adaptation can lead to improved performance, but too little demand from the environment can promote decline in competence.

The model is very general in its main concepts of individual competence and environmental press and Lawton & Nahemow (1973) point out that the model is a start for further theoretical developments, as the associations are most likely specific to interactions of particular environmental and individual characteristics and behavioral outcomes. For urban adults the nearby environment is the most likely walking environment. It provides space and destinations for walking, regardless whether the walking is for exercise, means of transportation or simply spending time outdoors.
3 WALKING ACTIVITY AMONG OLDER PEOPLE

3.1 Walking as physical activity

Physical activity is often defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (Caspersen et al., 1985). Exercise, being one form of physical activity is “planned, structured, and repetitive bodily movement” with an aim to improve or maintain physical fitness. People can also be physically active without consciously exercising, for instance, when going grocery shopping and running errands.

Walking is a form of physical activity that can be carried out for the purpose of exercise or as a means of transportation. American Heart Association recommends moderate physical activity for older people as opposed to vigorous physical activity, to enhance adherence and motivation (Nelson et al., 2007). Therefore, walking is an excellent form of physical activity for older people. Furthermore, walking is closely linked to other everyday activities of the elderly, such as meeting people, going shopping, running errands, and moving about in the nearby outdoor environment in general.

3.2 Assessing walking activity

Walking activity can be assessed with a variety of measures, both objective and subjective. Objective measures include accelerometers (Hall & McAuley, 2010) and pedometers (Ewald et al., 2010) to assess walking activity by step counts. The benefit of objective measures is their accuracy. However, there may be a great deal of daily and seasonal variability in walking activity. These assessments are often conducted only for a few consecutive days, whereas, randomly chosen days over the course of year would result into more accurate assessment of the general walking activity. (Togo et al., 2008)

Subjective evaluations of walking activity have often been used in studies of physical activity among older people, usually by asking the participants to rate the frequency of walking (e.g.
Mäkilä et al., 2010) or time spent walking (Armstrong & Morgan, 1998). The benefit of subjective evaluations is that they are less expensive and time consuming to carry out compared to objective measures. Furthermore, questions of walking activity can include the purpose of walking, whether it is for exercise (e.g. Mäkilä et al., 2010) or habitual, means of transportation (Armstrong & Morgan, 1998). The intensity of walking on the other hand is more difficult to assess. Older people may spend more time walking due to having more free time and lower functional ability compared to younger people, but they may walk slower. In general, there is a great deal of variability found in reliability of self-administered physical activity questionnaires and in a study by Bonnefoy et al. (2001) few were reliable and in agreement with objective measures. However, objective and subjective measures can assess different types of walking.

3.3 Individual factors associated with walking activity

3.3.1 Age, gender, cohort

In general, physical activity declines with age, which has been shown in several longitudinal studies (Mäkilä et al., 2010; Armstrong & Morgan, 1998; Bennett, 1998). However, there is variation according to gender and the type of activity. The general decline in physical activity behavior is faster among women compared to men (Mäkilä et al., 2010). Men have reported being more active in leisure time physical activities (Anear et al. 2009), and to participate more in different types of physical activity. Furthermore, women reported more indoor activities and men more outdoor activities (Armstrong & Morgan, 1998)

Walking is a common type of physical activity among both men and women and among all age groups; however, there are cohort and gender differences. Surveys on leisure-time walking activity among adults in the United States between the years 1987-2000 showed that the prevalence of reporting walking was higher in older age groups. Among young adults, women were two-three times more likely to report walking compared to men, but among older adults the prevalence of walking was similar. (Simpson et al., 2003)
The worse health of women might contribute to the gender difference. Older women with a higher physical activity level had less cardiovascular and musculoskeletal diseases than less active women; this difference was not observed among the men (Hirvensalo et al., 2000). An American study covering different age cohorts discovered that after adjusting for health, the gender differences disappeared. (Shaw et al., 2010).

There are differences in physical activity behavior between birth cohorts. A Finnish study discovered that the prevalence of leisure-time physical activity increased among younger cohorts, and the prevalence of occupational and commuting physical activity decreased (Borodulin et al., 2007). Perhaps physically less straining work and commuting by car has left younger cohorts with more time and energy for leisure-time physical activity. Also, younger cohorts may be more likely to consider walking as a physical activity for exercise, not only means of transportation.

### 3.3.2 Socioeconomic status

Individual level measures of socioeconomic status (SES), such as income, education and occupational status as well as neighborhood socioeconomic status are associated with physical activity. In cross-sectional studies, older people with a higher income report being more physically active than those with lower income (de Melo et al., 2010) and the same difference is observed between people living in neighborhoods characterized with a higher or lower SES (Annear et al., 2009). Walking, on the other hand, is a type of physical activity that should be accessible and easy to most, and less influenced by financial situation or education. However, the neighborhood SES may influence walking more than individual SES. A cohort study found that there was an association between neighborhood SES and the amount of walking reported after a 4-6-year follow up (Michael et al., 2010). In addition, close access to recreational activities was associated to walking only in the higher SES neighborhood.
3.3.3 Health and functional ability

Health assessed by chronic conditions, functional ability as well as the experience of health is related to being physically active. During an 8-year follow-up in the Evergreen study, in Jyväskylä, Finland, women who maintained a higher level of physical activity had less musculoskeletal and cardiovascular diseases (Hirvensalo et al., 2000), but among men the relationship between health status and physical activity was not found. Taking more medications increases the risk of stopping exercise (Cohen-Mansfield et al., 2010). Walking is positively associated with both objective (Simonsick, 2005) and subjective (Dier & Hirsch, 2010) health. Health problems may lead to pain and in a cross-sectional study Salpakoski et al. (2011) discovered that musculoskeletal pain increased the risk being physically inactive, without much influence from objective health measures. However, poorer health is not necessarily only a barrier, it can function also as a motivation to exercise (Nelson et al., 2007; Mäkilä et al., 2010).

Better functional ability is related to higher walking activity (Satiriano et al., 2010; Puthoff, 2008; Simonsick, 2005; Rantanen et al., 1999) and starting exercise (Cohen-Mansfield et al., 2010). There is a danger of a vicious cycle as lower functional ability increases the risk of physical inactivity, which may contribute to development of disability (Rantanen et al., 1999). Similarly, better health and functional capacity are related to increased walking activity, and as a result, to less decline in functional ability (Simonsick, 2005). Those with mobility limitations tend to report health as a barrier while healthier older people tend to view physical activity as a means of promoting health. (Rasinaho et al., 2007).

3.4 Environmental factors associated with walking activity

3.4.1 Assessing the outdoor environment

In studies of associations between environmental features and physical activity, the environment has been assessed with a variety of ways. Environment can be assessed objectively using already
existing data, analyzed with geographic information systems. The environmental characteristics of interest can be for instance, distance to services, housing density, land use diversity, traffic, public transportation, and household socioeconomic status information. Objective measures also include systematic observational methods, such as audits, conducted by the researchers. The perceived measures of physical environment include collecting environmental information with interviews or questionnaires. (Brownson et al., 2009). Questions can be descriptive or evaluative, asking the participants to report environmental features, or to identify them as assets, problems as such or in relation to, for instance, physical activity (Satariano & McAuley, 2003).

A great deal of studies on the effects of neighborhood on physical activity such as walking has been carried out in the United States using objective assessment and GIS, and describing neighborhoods according to SES, partly due to easy access to such data. However, this method has been criticized for not investigating the mechanisms through which SES affects physical activity (Diez Roux, 2002).

Objective measures may not be able to capture the relevant environmental features for walking efficiently. Even though neighborhood is a likely place for walking, the routes and destinations one chooses influence the barriers faced. Michael et al. (2006) used both objective and perceived measures of neighborhood environment and their association between self-reported walking. Perceived environment was assessed by asking the subjects to report presence of certain environmental features and environment related problems. Objective assessment of built environment consisted of data collected by trained research assistants. The objective and perceived environmental measures did not agree well, as the elderly participants reported sidewalk obstructions where the researcher did not. Poor agreement between objective and subjective measures of built environment was also found by McGinn et al. (2007). On the other hand, in their review Lin & Moudon (2009) found evidence that objective measures have stronger associations with walking activity, however, the studies in the review included did not focus on older people.
3.4.2 Outdoor environment and walking activity

A great deal of variety in research topics and findings has lead to a variety in ways to assess environment and walking activity. Findings have shown a supportive environment, that is, environment associated with higher level of walking activity, to be high in socioeconomic status and to include destinations for walking (e.g. Michael, 2010). By comparing neighborhoods, Annear et al. (2009) discovered that leisure-time physical activity in general was higher in high SES neighborhood, and older people living there reported having more aesthetically appealing walking space, and feeling safe. King et al (2003) discovered that having a park, walking trail or stores within walking distance was associated with higher pedometer ratings. De Melo et al. (2010) found only access to services to be related to higher pedometer rating. The latter study measured walking activity only for 3 days, which may not be long enough to assess general walking activity. Furthermore, the type of walking activity, whether it is for exercise or for transport, cannot be determined only by pedometers. Destinations, such as services may be less related to walking for exercise. Interestingly, the neighborhood SES seems to influence the association between having destinations in nearby outdoor environment and walking activity, as Michael (2010) discovered that parks and trails were related to higher walking activity only in the higher SES neighborhoods.

Besides providing space and destinations for walking, environment can pose problems and barriers for the elderly pedestrians. Neighborhood problems have often been associated with low SES neighborhoods, which have been found to be related to less walking activity (Michael et al., 2010). People living in low SES neighborhoods are less likely to live near a trail (Michael et al., 2010), and they have reported crime, antisocial behavior, general neighborhood degradation, litter and graffiti as reasons making the environment less suitable for walking (Annear et al., 2009). Proximity of trails and parks are not related to increased walking in low SES neighborhoods similarly as in high SES neighborhood (Michael et al., 2010), perhaps due to above mentioned reasons. Also, living in an area that is less compact and has less land-use mix is related to less walking (Satariano et al., 2010)
Studies using subjective evaluative assessments are fewer than those using objective. Annear et al. (2009) asked their urban living study participants what they considered barriers to leisure-time physical activity. The participants reported crime, unattractive neighborhood and traffic, however, the association between specific barriers and walking activity was not investigated in this study..

Dawson et al. (2007) used a number of perceived neighborhood barriers for walking as an indicator of environmental press and discovered that reporting more than one barrier was associated with reduced levels of leisure-time walking.

According to the competence-press model, those with lower competence may be more influenced by the environment (Lawton & Nahemow, 1973); however, few studies have investigated the role of health in the environment-walking relationship. In a study comparing older people with different levels of lower-body functioning, block length was not associated with walking among those with poor lower-body functioning, as it was among those with excellent lower-body functioning (Satariano et al. 2010). Some studies have found environment-walking association to disappear when adjusting for physical function (De Melo et al. 2010), or that reduced walking activity was more associated with reporting health related barriers compared to perceived environmental barriers (Dawson et al., 2007).

It is possible that environmental barriers contribute to decline in functional ability by decreasing physical activity. A study on community-living elderly (Balfour et al. 2002) found out that there is a relationship between perceived environment and mobility, as self-reported neighborhood problems predicted functional loss after one year in a sample of functionally healthy people of 55 or older.
4. AIM AND RESEARCH QUESTIONS

The aim is to study whether walking for exercise is related to perceived barriers in the environment among urban older adults, and whether health influences this relationship as suggested by the competence-press model (Lawton & Nahemow, 1973). The research questions are:

1. Are perceived barriers in the environment associated with walking activity?

2. If perceived barriers in the environment are associated with walking activity, is the relationship influenced by health status?
5. PARTICIPANTS AND METHODS

5.1 Participants

The study was a part of a randomized control trial Screening and counseling for physical activity and mobility (SCAMOB) conducted by Jyväskylä University. The study targeted all community-living people living in the city center of Jyväskylä, born 1922-1928. The inclusion criteria included: being able to walk at least 0.5 km without assistance, only moderately physically active or sedentary, no memory impairment, no medical contraindications for physical activity and informed consent to participate. This study is based on the baseline data (n=632) collected in 2003 at home interviews using standardized questionnaires. The sample consisted of 632 older adults, of which 159 were men and 473 women. The mean age for men was 77.5 and for women 77.6.

(Leinonen et al., 2007)

5.2 Data acquisition and variables

Walking activity was assessed by asking the participants whether they do some type of physical activity for condition/health. If a participant answered yes, he/she was asked to rate frequency of different types of physical activity. Walking was one of the physical activities included. Walking activity was reported for both summer and winter, options being: no walking, less than once a month, 1-2 times/month, once a week, 2-3 times/week, more than 3 times/week. According to answers the participants were categorized into walkers (reported some walking) and nonwalkers (reported to not to walk at all). To be able to investigate the relationship between environmental barriers and walking activity without the influence of winter weather conditions only data on summer walking activity was included in this study.

Perceived environmental barriers were assessed by asking the participants whether in their nearby environment the following barriers to outdoor mobility were present: lack of resting places, long distances to services, noisy traffic, dangerous crossroads, hilly terrain or poor street conditions.
Based on the answers a number of barriers was calculated for each participant, categories being no barriers, one barrier and two or more barriers.

Health status was assessed with presence of chronic conditions and self-rated health. Participants were asked whether they had a disease or injury diagnosed by a physician that has lasted more than 3 months. The participants could list a maximum of 10 diseases. The information on the presence of pulmonary disease, cardiovascular disease and musculoskeletal disease was included in this study. Self-rated health was assessed by a telephone interview before the home interviews were conducted, options being: excellent, good, not so good, poor. Due to a small number of answers in the extreme categories, the answers were categorized into excellent-good and not so good-poor for the analysis.

The participants were asked to rate their economic situation on a five point scale: very good, good, moderate, poor, and extremely poor. Due to a small number of answers in the extreme categories, the answer were categorized into very good-good and moderate-poor for the analysis.

5.3 Statistical analysis

Cross tabulation was used to describe the baseline characteristics according to gender. Differences between men and women in all the variables included in the study were examined with chi-square test for categorical variables and t-tests for continuous variables. Further analysis was conducted for men and women separately. Differences between walkers and nonwalkers were investigated with cross tabulation, again, using chi-square and t-tests to determine differences between the groups. P value <0.05 was considered to be statistically significant. Finally, the risk of being a nonwalker was investigated with logistic regression analysis. Three models were created, all adjusted for age. In the first model, environmental barriers were included. Chronic conditions were added to the second model, and self-rated health to the third. The data was analyzed with PASW statistics 18 for Windows.
6. RESULTS

Baseline characteristics according to gender are presented in Table 1. Two thirds of men and almost half of women reported no barriers while 17% of men and 28% of women reported having 2 or more barriers. Of men 13% reported poor street conditions, 13% hills, 4% long distances, 8% lack of resting places, 13% noisy traffic and 12% dangerous crossroads; correspondingly, 21% of women reported poor street conditions, 26% hills, 11% long distances, 11% lack of resting places, 12% noisy traffic and 13% dangerous crossroads (Data not shown). Majority of subjects reported at least some walking, only 16% of men and 18% of women reported not walking at all.

There was no statistically significant gender difference in walking activity. However, there was a difference in the number of perceived barriers (p=0.007) with women perceiving more barriers. Men and women differed in the following barriers: poor street conditions (p=0.015), hills (p=0.001) and long distances (p=0.010), women reporting more of each (Data not shown). Furthermore, women were more likely to be diagnosed with musculoskeletal disease (p<0.001) and to rate their economic situation as moderate-poor (p=0.023). There was no gender difference in other health variables or age.
Table 2 shows how the study variables are distributed among walkers and nonwalkers. Among women, there was a statistically significant association between the number of perceived environmental barriers and walking activity (p=0.030). The proportion of those reporting two or more barriers was higher among nonwalkers (38%) compared to walkers (26%). There was a similar trend among men (31% and 14%), however, the difference was not statistically significant (p=0.094).
Self-rated health was also associated with walking activity among both men (p=0.007) and women (p=0.034). Among walkers, the participants were quite equally distributed to excellent-good and not-so-good-poor categories, but among nonwalkers the proportion of those rating their health worse was greater (77% of men, 67% of women). Other health variables, age and self-rated economic situation were not associated with walking activity.

Table 2. Association of walking activity and baseline characteristics among 75- to 81-year-old community-dwelling men and women

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Walking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes n=133</td>
<td>No n=26 p-value</td>
</tr>
<tr>
<td>Age†</td>
<td>Mean±SD</td>
<td>Mean±SD</td>
</tr>
<tr>
<td></td>
<td>77.5±2.0</td>
<td>77.3±1.9</td>
</tr>
<tr>
<td>Number of chronic conditions†</td>
<td>2.8±1.9</td>
<td>3.0±2.3</td>
</tr>
<tr>
<td>Perceived environmental barriers°</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>Pulmonary disease°</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Musculoskeletal disease°</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Cardiovascular diseases°</td>
<td>71</td>
<td>70</td>
</tr>
<tr>
<td>Self-rated health°</td>
<td>Excellent-good</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Not so good-poor</td>
<td>48</td>
</tr>
<tr>
<td>Self-rated economic situation°</td>
<td>Very good - good</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Moderate - poor</td>
<td>50</td>
</tr>
</tbody>
</table>

† t-test for independent samples
°Chi-square test
SD= standard deviation
Results of the logistic regression analysis are presented in Table 3 for men and Table 4 for women. Men were at a higher risk of being nonwalkers if they reported having two or more environmental barriers (OR 3.042, 95% CI 1.091-8.480). The risk slightly increased when chronic conditions were added; however, self-rated health attenuated the association. Among women, there was also an increased risk of being a nonwalker if reporting two or more barriers. The association was, however, not statistically significant (OR 1.56, 95% CI 0.93-2.63). Also, none of the health variables were significantly associated with the increased risk of not walking among women; neither did adding them to the model 3 change much the association between environmental barriers and walking activity.

**Table 3. Factors associated with not walking in logistic regression analyses among men**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
<th>Model 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td>Environmental barriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1.48 0.50-4.34</td>
<td>1.37</td>
<td>0.46-4.15</td>
<td>1.36</td>
<td>0.43-4.26</td>
</tr>
<tr>
<td>1</td>
<td>1.48</td>
<td>0.50-4.34</td>
<td>3.22</td>
<td>1.12-9.23</td>
<td>2.76</td>
<td>0.92-8.32</td>
</tr>
<tr>
<td>2 or more</td>
<td>3.04</td>
<td>1.09-8.48</td>
<td>2.76</td>
<td>0.92-8.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>0.91</td>
<td>0.36-1.33</td>
<td>0.79</td>
<td>0.30-2.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>1.58</td>
<td>0.45-5.60</td>
<td>1.10</td>
<td>0.30-3.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musculoskeletal disease</td>
<td>0.77</td>
<td>0.30-1.93</td>
<td>0.59</td>
<td>0.22-1.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-rated health</td>
<td>3.526</td>
<td>1.25-9.98</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: Model 1: adjusted for age; Model 2: Model 1+adjustment for cardiovascular disease, pulmonary disease and musculoskeletal disease; Model 3: Model 1+Model 2+ adjustment for self-rated health
Table 4. Factors associated with not walking in logistic regression analyses among women

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>95% CI</td>
<td>OR</td>
</tr>
<tr>
<td>Environmental barriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1.56</td>
<td>0.56</td>
</tr>
<tr>
<td>2 or more</td>
<td>1.56</td>
<td>0.56</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>1.35</td>
<td>0.81-2.25</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>0.79</td>
<td>0.42-1.50</td>
</tr>
<tr>
<td>Musculoskeletal disease</td>
<td>1.53</td>
<td>0.93-2.52</td>
</tr>
<tr>
<td>Self-rated health</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Model 1: adjusted for age; Model 2: Model 1+adjustment for cardiovascular disease, pulmonary disease and musculoskeletal disease; Model 3: Model 1+Model 2+ adjustment for self-rated health
7 DISCUSSION

In this study perceived environmental barriers were associated with walking for exercise. Men who reported 2 or more barriers in their nearby outdoor environment were three times more likely to not walk at all compared to those who reported no barriers. Among women the risk was 1.5 times higher. Chronic diseases did not explain the association, however, among men self-rated health attenuated the association between perceived environmental barriers and walking activity.

This study showed that perceived barriers in the nearby outdoor environment increase the risk of not walking for exercise. A study with younger and more active participants showed similar results as reporting more than one barrier was associated with a reduced level of walking (Dawson et al. 2007). In both of these studies the barriers of interest were closely connected to the outcome. Dawson et al. (2007) asked specifically about barriers for neighbourhood walking and in the current study participants were asked to report nearby outdoor barriers for physical activity, which most likely is the environment of leisure-time walking. To my knowledge, these are the only studies using number of barriers as an indicator of environmental press in relation to walking for exercise. Reporting two or more neighbourhood problems has also been associated with a decline in physical function, even more so in lower-body function, after a 1-year follow-up among a cohort of older adults aged 55 years or more (Balfour et al., 2002). However, findings on the relationship between some other perceived neighbourhood problems, for instance fear of crime, and physical activity have been inconsistent. (Foster & Giles-Corti, 2008).

Among women, the increased risk of not walking for exercise if reporting environmental barriers did not reach statistical significance. One possible reason may be that if men do not perceive the environment suitable for walking they simply choose another way to be physically active. Compared to women, men tend to have more variety in types of physical activity, and participating in supervised exercise classes is more common (Mäkilä et al., 2010). Women, on the other hand, may choose to walk despite perceived environmental barriers or health problems. Living alone is more common among elderly women, and as a result, they may be more used to walking to go grocery shopping, run errands. Women also rated their socioeconomic status worse than men in this study, and may choose walking as a more economic option for exercise.
In the current study, health was included as a covariate, and a gender difference was observed in how health status is related to the relationship between perceived environmental barriers and walking activity. Among men, self-rated health explained in part the increased risk of not walking at all for exercise when reporting two or more environmental barriers for physical activity. Health has been associated with walking activity in previous studies (e.g. Simonsick, 2005; Dier & Hirch, 2010), however, health may influence physical activity of women more than men. Hirvensalo et al. (2000) found out that among women musculoskeletal and cardiovascular diseases were associated with less physical activity, but among men there was no association. Similarly, self-rated health has been found to be related to walking activity (Diehr & Hirsch, 2010), but in a study by Shaw et al. (2010) self-rated health mainly explained PA of women. For some older people, health problems function as a motivation to be physically active (Mäkilä et al., 2010). Self-rated health may be more related to the experience of pain, which is associated with less physical activity (Salpakoski et al., 2010). Chronic diseases, however, do not necessarily cause pain if managed well, and many older people may choose to be physically active as a part of disease management.

In this study, majority of participants perceived no barriers in their environment, 62 % of men and 49 % of women. Similar prevalence was reported in a previous study with healthier and more active participants, and being female, not married and reporting health-related barriers to walking were increased the risk of reporting neighborhood problems for walking (Dawson et al., 2007). If living alone and having to use walking as a means of transportation is more common among women, they may report more environmental barriers due to being more exposed to the nearby environment.

The competence-press model was used as a theoretical framework in the current study. According to the model, physical activity is a result of environmental press and individual competence. When talking about environmental press Lawton & Nahemow (1973) refer to the objective evaluation of the environment. In this study, however, perceived environmental barriers were used to indicate environmental press. The benefit of choosing perceived barriers is that they may better reflect the barriers encountered by the study participants; however, the perception of
barriers may also be affected by individual factors such as health. Therefore, perceived environment could also be considered as individual’s perception of person-environment fit, and perceiving barriers in the environment may be an early sign of mobility limitations. Furthermore, the perception of barriers can be influenced by several factors that were not addressed in this study, such as motivation; those not interested in physical activity, may not perceive barriers for it either.

Indicating environmental press with a number of barriers may be especially useful when assessing perceived barriers because barriers may be context specific. For instance, crime and neighbourhood SES differences are often included in American studies (e.g. Balfour et al., 2002; Dawson et al., 2007; Michael et al., 2010), but in the Finnish context they would be less relevant because the differences in neighbourhood SES and crime rate are smaller. Also, there are differences within countries and cities in e.g. how many hills there are in an urban environment. Perceived environment may be more relevant for the walking outcome as the subjective evaluation of the environment targets the environments actually used by the participants. Objective evaluation of the neighborhood does not necessarily agree with the participants’ evaluation of the environmental barriers (Michael et al., 2006). However, combining subjective and objective environmental data could result into more rich environmental information by enabling the investigation of how health and perceived and objective environment are interrelated.

The sample in this study consisted of 632 elderly participants living in the city center of Jyväskylä, Finland, who were originally recruited for Screening and counseling for physical activity and mobility (SCAMOB) project. As a result, this study has certain limitations that should be considered when interpreting the results and planning future research. According to the SCAMOB protocol both the most active older people and those who’s walking could be compromised due to health problems were excluded. The associations between perceived environmental barriers and walking activity could have been different if randomization would have been used in the selection of study participants. Therefore, the findings can only be generalized to sedentary community living urban older adults. Moreover, all the participants lived in the same area, which reduces the variability in the type and number of perceived environmental barriers. Finally, as most studies on the association between environmental factors
and walking activity, this too is cross-sectional. Prospective studies are needed to study causality. The strength of this study is a large sample and a possibility to study a community-living sedentary population, since they may be more likely to experience environmental barriers. They are also the target population for physical activity promotion to prevent mobility limitations that may compromise independent living.

In conclusion, this study supports the observation that environment does play a role in physical activity, and more specifically whether one walks for exercise. Being an accessible form of physical activity with health benefits, walking should be promoted among older people. However, such efforts may be in vain if environmental barriers prevent older people from walking for exercise despite the will to do so. Future studies should investigate the underlying reasons for gender difference.
REFERENCES


