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Declaration of Conflicting Interest

In terms of financial interests, one author (SI) is a copyright holder and owner of the Housing Enabler (HE) instrument, provided as a commercial product (see www.enabler.nu). The other authors have no competing interests.

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ABSTRACT

Despite the fact that PA exerts beneficial effects on many age-related diseases and conditions, physical activity (PA) decreases with increasing age. Consequently, there is an interest in modifiable factors that may influence PA among older people. The purpose of this study was to examine the association between PA and the home environment in well-functioning older community-dwelling people.

Method: This study used a person-environment (P-E) fit perspective to the home environment, operationalized by means of assessments of functional limitations in 81 community-dwelling persons (median age 79 years) as well as environmental barriers in their home environments, including the nearby exterior surroundings. The analysis of the interaction between functional limitations and environmental barriers generates a score that express the magnitude of P-E fit problems. PA was rated with a questionnaire that covered household-related as well as recreational activities.

Results: We found a significant association between PA and the magnitude of P-E fit problems that explained 3.9 % of the variance in PA. The number of environmental barriers per se was not significantly associated with PA while functional limitations explained 6.8% of variance of PA.

Conclusion: In well-functioning older persons living in the community, environmental aspects of housing demonstrate a weak association with PA. While P-E fit explains more of the PA variance, functional limitations explain a greater share of the variation.

Background

The benefits of physical activity (PA) in older age are well established [1] and several recommendations on PA in older adults have been published [2–4]. In contrast, older adults represent the least active segment of the population. Data from the US suggest that only 26.1% of those 50 years and older adhere to recommendations on regular PA [5].

To design appropriate interventions promoting PA in older persons, a better understanding of determinants is warranted [6]. PA behaviour is affected by personal, social, and environmental factors. Several environmental characteristics were found to be associated with PA in older persons, such as accessibility to services [7], safety [8–10], climate [11], terrain [12], and aesthetics [13]. Research on PA is usually focusing on activities of moderate to high intensity walking for pleasure and exercise or sportive activities. Such activities take place outside the home environment. However, with increasing age older persons spend most of their time within their home environment [14]. Research in patterns of PA in older persons identified housework and gardening as the most relevant activities among older persons [15–17]. Hence, in research on motives for and barriers to PA among older persons the home environment appears to be a relevant aspect that merits further consideration.

Within research on aging and environmental aspects, issues of housing and neighborhoods are increasingly recognized as critical factors supporting or undermining individual functioning [18]. Results from studies in this field have established the need for an integrated approach taking personal as well as environmental components into account, in contrast to an isolated focus on either component. The notion of person-environment (P-E) fit is based on the ecological theory of aging (ETA) and the docility hypothesis [19–21], stating that individuals with low functional capacity are much more vulnerable to environmental demands than those with high capacity. That is, environmental details are critical to what individuals with low functional capacity can manage in their everyday lives. Applying the ETA, physical barriers in the environment are not necessarily problems per se. Rather, they cause different magnitudes of P-E fit problems for different persons, depending on each individual's functional capacity [22]. To characterize the fit between people with functional limitations and their home environment the so-called Housing Enabler was developed [23]. To express the magnitude of P-E fit problems in an individual case, the Housing Enabler creates an integrated score generated by the presence of environmental barriers and the profile of functional limitations of the person living within the specified home environment.

Aims

The primary purpose of the current study was to examine the association between PA – defined as household-related activity and recreational activity - and P-E fit among older community-dwelling persons living in an urban setting, by use of the Housing Enabler instrument. Furthermore, we tested the hypothesis that the association between functional limitations, environmental barriers, P-E fit and PA would be greater in the oldest old (80 years and older) compared to younger seniors (65 – 79 years), and greater in women than in men.

Methods

Participants

The population of interest were older persons (65 years and older) living independently in the community. From this population a convenience sample was drawn. Participants were recruited from two sources:

(1) 393 members (> 74 years) of a public health insurance company, living in the Stuttgart area, received a written invitation to participate. They were identified via ZIP codes and invitations were sent out in blocks of several ZIP codes; those closest to the study centre were chosen first. Invitations were stopped when 100 potential participants were registered. Spouses were invited to participate regardless of their membership with the insurance company. Of these 393 members invited, 70 responded with 12 spouses being interested to participate as well. In this way, 82 potential participants were identified.

(2) During the annual meetings of retired workers (65 years and older) of a local company as well as their spouses, attendees were invited to participate in the study. Twenty potential participants were recruited during these meetings.

Participants were included if they were living independently in the community, had no severe life-limiting medical problems as judged by a physician, and gave informed consent to participation in the study. Out of the 102 potential participants, 91 fulfilled the inclusion criteria and completed all assessments. Reasons for drop-out were insufficient language skills (n=1), death (n=1), acute medical problems (n=3), and withdrawal of consent (n=6). Since core questions in the questionnaire administered required intact memory function, participants with cognitive impairment - as defined by the screening instrument used (ref in) - were afterwards excluded from further analysis (n=10). Thus, the final sample consisted of 81 participants (42 men, 39 women).

For the analysis, the sample was divided according to age in those younger than 80 years (n = 45; 24 men, 21 women) and those 80 years or older (n=36; 18 men, 18 women), and according to sex (42 men and 39 women). The age classification was adopted according to the Geriatric Medicine Section of the European Union of Medical Specialties (ref in?). Characteristics of participants and their housing situation are displayed in Tables 1 and 2.

TABLE 1 & 2 IN HERE

Procedure

Between May and November 2009, participants were assessed during home visits on two consecutive days with each visit lasting on average 60 – 90 minutes. The assessments were performed by an occupational therapist and a physician (P.B. and A.K.), both trained in the use of the instruments used.

The study was approved by the ethics committee of the local university. All participants gave their written informed consent.

Measurements

Functional limitations and dependence on mobility devices were assessed using a version of the Housing Enabler instrument [24], with sufficient inter-rater reliability (25). It was translated into German under the supervision of the originator of the instrument (SI; second author). The instrument is administered in three steps. The first step is the dichotomous assessment (present/not present) of 13 items on functional limitations (cognition, perception, mobility) and two items on dependence on mobility devices (personal component). In the current study, the number of functional limitations / dependence on mobility devices was used as a variable (functional limitations) with values ranging from 0-15. In the second step, the occurrence of 188 potential environmental barriers in the home and immediate outdoor environment (defined according to official national standards and guidelines) was dichotomously assessed (present/not present) (environmental component) [25]. The items concern design features such as stair height and depth as well as features traditionally defined as home hazards (e. g. slippery floor). In the current study, the number of environmental barriers was used as a variable (environmental barriers) with values ranging from 0-188. In the third step of the administration of the Housing Enabler, a total P-E fit score was calculated expressing the magnitude of problems; higher scores denote more problems. That is, for each environmental barrier item, the instrument includes predefined severity ratings (score ranging from 0 to 4) associated with the combination of each environmental barrier to the 15 items of the personal component of the instrument. As an example, missing handrails on both sides of a stair generates no points in combination with severe hearing problems, but 4 points in combination with dependence on mobility devices.

PA was assessed using the PhoneFITT, a brief, valid and reliable instrument developed for community-dwelling older persons [26]. In brief, frequency and duration of household-related and recreational activities were rated covering a typical week in the past month. The usual duration of each activity reported was categorised into intervals (0-15, 16-30, 31-60 or >60 minutes), coded 1-4. Sum scores were calculated by adding the frequency and duration for each activity, thereafter summed for all activities. Higher PA scores represent higher levels of PA.

To describe the sample, various characteristics and aspects of health were assessed. Cognition was tested with the 6-item Short Orientation Memory Concentration Test (SOMC) [27]; values > 10 suggest cognitive impairment. Disease burden was assessed using the Charlson Comorbidity Index [28]. Fear of falling was assessed using the German version of the Falls Efficacy Scale International (FES-I) [29]. Depressive symptoms were assessed by the 15-item Geriatric Depression Scale (GDS) [30]. Pain was assessed with the 5-item subscale on pain from the Western Ontario and Mac Master Universities osteoarthritis index (WOMAC) [31]. To describe physical performance, we used the Short Physical Performance Battery [32] and modified the instructions as follows: Gait speed was assessed timing participants walking four meters in their preferred speed by means of a stopwatch, allowing the use of walking aids. We used the mean gait speed of two trials. Sit-to-stand transfer (5-Chair Rise Test) was assessed by timing one trial in their usual speed. Balance was tested while the participant stood in different positions without any support (open stance, closed stance, semi-tandem, and tandem stance). If a participant was able to keep a position for 10 seconds, the next-most challenging position was tested. The sum of seconds performed in all positions was calculated, with a maximum of 40 seconds.

Statistical analyses

Differences regarding WHAT? between the two age groups and sex were calculated with the Mann-Whitney U Test. Bivariate associations between age, Short FES-I, GDS-15, WOMAC, Functional limitations, Environmental barriers, P-E fit score and PA were calculated by Spearman's coefficient of correlation (r_s). The significance level was set to uncorrected α = 5% (two-sided). Analyses were performed for the total sample as well as for age groups and sex, respectively.

Based on the nature of our research question, regression analyses were computed. We planned three different binary models with PA used as the dependent variable in each model, and functional limitations (model 1), environmental barriers (model 2), P-E fit score (model 3) as the respective independent variable. A plot of the residuals versus the predicted dependent variable displayed no violations of assumptions for any of the three models. A fourth, multivariate model with PA as the dependent variable and functional limitations and environmental barriers as dependent variables (model 4) was tested. Again a plot of the residuals versus the predicted dependent variable displayed no violation of assumptions. Multi-collinearity of the variables environmental barriers and functional limitations was examined with regression diagnostic procedures using SPSS. No problems were indicated; the tolerance ranged from 0.885 to 0.930, and the variance inflation factor ranged from 1.075 to 1.129.

All analyses were calculated for the total sample as well as for the two age groups.

All analyses were conducted using the SPSS version 16 software (SPSS Inc., Chicago, IL, USA).

Results

Among the 81 participants included, there was a high level of functioning with low levels of depressive symptoms, pain and fear of falling and few comorbidities (Table1). Most participants lived in apartments situated in a multi-dwelling building and owned by the participants.

Age-related sub-groups

The subgroup of 36 older participants performed less well on physical performance tests, had more diseases and functional limitations. The number of environmental barriers was not significantly different between younger and older participants, even though the older participants lived in dwellings that were 10 years older. However, their higher number of functional limitations resulted in higher P-E fit scores. The level of PA in the two age groups was not significantly different (Table 2).

Sub-groups according to sex

Men and women displayed similar demographic characteristics but the men demonstrated better functional performance. The number of functional limitations, environmental barriers and the P-E fit score were not significantly different between men and women. In terms of frequency and duration of household-related and recreational PA, women were significantly more active than men. The difference was driven by more household-related activity in women.

Correlation analyses

The magnitude of P-E fit problems was significantly correlated with PA in the subgroup of older participants (r_s = - 0.338, p = 0.044). We found a weak correlation between PA and functional limitations in the total sample (r_s = - 0.245, p= 0.027) and a moderate correlation in the subgroup of older participants (r_s = -0.513, p= 0.001) and the subgroup of women (r_s =

-0.524, p= 0.001) (Table 3). The number of environmental barriers did not correlate with PA in neither the total sample, nor in any of the subgroups. PA did not significantly correlate with any of the variables of interest in the subgroup of younger participants or men.

TABLE 3 IN HERE

Functional limitations explained 6.8 % of PA while the magnitude of P-E fit problems (P-E fit score) explained 3.9 % of PA in the total sample (Table 4). Among the older participants the number of functional limitations explained 19.6 % of PA and again the magnitude of housing accessibility problems explained PA to a lesser extent (11.1 %). Among women, the magnitude of P-E fit problems did not reach statistical significance while functional limitations explained 21.5% of PA. Multiple linear regression analyses (Model 4) with number of environmental barriers and number of functional limitations as independent variables did not result in higher levels of adjusted R square (6.6 % versus 6.6% in the total sample, 19.6 versus 18.5 in the older age group and 19.5% versus 21.5% in women).

TABLE 4 IN HERE

Discussion

In this study, we explored the association between P-E fit and overall PA in community-dwelling older persons, including both household-related and recreational activity. In our convenience sample of well-functioning older people, the number of environmental barriers in the housing environment alone does not explain the level of household-related and recreational PA. We found a weak association between the magnitude of P-E problems and PA. Apparently, the association between the P-E fit score in housing and PA seems to be mainly driven by the functional capacity of older people and not by the environmental barriers. Our results raise questions about the impact of the home environment on PA levels in older persons.

While the association between PA and functional limitations has been described previously [17, 33, 34], the association between the home environment and the quantity of PA has not been explored so far. To characterize the home environment, we chose a well established instrument to comprehensively explore the home environment of each participant alongside their functional limitations [23]. These personal and environmental components were integrated to express the magnitude of P-E fit problems in each individual. In our sample, the number of environmental barriers was not significantly different between the two age groups or between men and women. By means of the instrument used to express P-E fit problems (ref), the occurrence of environmental barriers is juxtaposed to the profile of functional limitations of the individual, generating a P-E fit score. Since older participants and women demonstrated more functional limitations, they displayed a higher magnitude of P-E fit problems as expressed by the higher P-E fit score - although the number of environmental barriers was not significantly different. This finding is in line with previous work and the ETA (needs a ref or two). This model is stating that persons with lower levels of functioning are more sensitive to the demands of the environment than persons with higher levels of functioning, resulting in more problems in the interaction of a persons within his environment [19, 20, 25, 35] . As a consequence, we found no significant association between the magnitude of P-E fit problems and PA in the younger participants, but among those 80 years or older and women. This finding implies that the relevance of P-E fit problems for PA is higher among those with a higher level of functional limitations.

Turning to the results of the regression analyses, it is evident that functional limitations and dependence on mobility devices explained PA to a greater extent than environmental barriers in the home. With PA as the dependent variable, this was not unexpected, even if this variable specifically concerned household-related PA. In earlier studies using activities of daily living instead of PA as an outcome results were in the similar direction [25, 36]. Even so, it is necessary to keep in mind that the P-E fit score is unique in character – it is not a measure of personal, nor of environmental aspects – it is a composite measure quantifying the relation between the person and the environment [24]. That said, we hereby know that functional limitations is the most important component of P-E fit as related to PA. As highlighted also in previous studies, environmental barriers per se are not significantly associated with activity in old age [36, 37].

The objective, standardized and detailed assessment of the home environment is a clear strength of this study. The validity of the Housing Enabler has been successively improved (new ref) and the instrument has good inter-rater reliablity [25]. The Housing Enabler was applied by two trained researchers and gives a comprehensive assessment of P-E fit in the home and the close neighborhood. Comparing our findings with previous work done in this field, one has to bear in mind that there are differences between the objective assessment of environmental aspects and the perceived relevance as judged by inhabitants. In a study on perceived barriers to PA, severely functionally limited older people reported environmental barriers in the outdoor environment as hindrances more often than persons with no or moderate limitations [38]. Strath et al. demonstrated the relevance of both aspects, objective and perceived, of neighbourhood walkability for determining moderate to vigorous PA of persons age 55 years and older [39]. As to the area of housing, work by Nygren and coworkers [40] show that there is a great complexity as concerns relations between objective and perceived aspects of housing, and they recommended the use of both perspectives in research on home and health in old age. Whether or not such perceived “usability” is of relevance in determining PA in older persons needs to be explored in future studies.

Another relevant difference and strength of our study compared to existing evidence is the definition and measurement of PA. Research on the association between the environment and PA is usually focusing on recreational activities, like walking for pleasure and exercise or sportive activities [39, 41]. Yet, most older adults undertake household-related PA but few participate in recreational PA [17, 42, 43]. In the present study, we chose a PA questionnaire that covers not only recreational but also household-related activities (five household-related activities and gardening) [26]. We expected it to be sensitive to P-E fit problems of the home environment. In fact, the total PA score in our sample was dominated by household-related activities. Reflecting traditional gender roles, we found women to be more active than men despite their poorer performance on the physical performance measures. We cannot exclude the possibility that the PA questionnaire used in this study overestimates household-related activities, with a risk of gender bias.

This study has several limitations. First, we studied a convenience a sample of older adults with high physical performance, low fear of falling and few medical problems. In contrast to other studies [44] we did not observe participants 80 years of age and older to be less active than younger participants. Evidently, we cannot exclude a selection bias with predominantly active persons responding to the invitation. However, the significant differences in physical performance and prevalence of medical problems – both being associated with PA - between both age groups argue against a pronounced systematic bias. The number of participants with a higher number of functional limitations (four or more) was too low (n=21) to allow for a valid subgroup analysis. Therefore, the results of this study are not applicable to older adults with more complex profiles of functional limitations.

Secondly, in this study functional limitations were defined according to the Housing Enabler instrument [24]. That is, besides mobility-related functional limitations and dependence on mobility devices, also cognitive and perceptual limitations were assessed. Due to the small sample size we could not restrict our analysis to mobility-related functional limitations to test whether the association between function limitations / dependence on mobility devices and PA was predominantly related to, for example, limitations of lower limb functions or stamina. Moreover, the instrument does not characterize the neighbourhood environment except for the immediate outdoor environment (entrance area, way to garbage bin, parking area). Unlike other studies we did not include characteristics of the neighbourhood such as density of buildings, access to services, street connectivity, infrastructure of walking, safety, or aesthetics [39]. We cannot exclude confounding of our findings by the lack of data on such neighbourhood characteristics. Furthermore, PA was based on self-report. Self-report questionnaires are subject to recall bias and correlate only weakly to moderately with objective measures [45]. However, the questionnaire used in this study has demonstrated good correlation with an objective measure in a sample of community-dwelling older adults [26].

Conclusion

This study indicates that in well-functioning older persons living in the community, objective environmental aspects of housing demonstrate a weak association with PA. Further research including more frail persons is needed to clarify the influence of the home environment on PA.

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Table 1

Characteristics of participants; total sample, two age groups (< 80 years; 80 years and older) and sex.

	All (N = 81)	Younger Participants (N = 45)	Older Participants (N = 36)		Men (N = 42)	Women (N = 39)	
	Median, (q1 – q3)*	Median, (q1 – q3)*	Median, (q1 – q3)*	p-value**	Median, (q1 – q3)*	Median, (q1 – q3)*	p-value**
Sex (Men/women)	42/39	24/21	18/18	0.767			
Age	79 (76 – 83)	76 (74 – 78)	83.5 (81 – 85)	< 0.001	79 (17.8 – 82.3)	79 (75-83)	0.879
BMI	27.5 (25.3 – 30.3)	27.4 (25.3 – 30.3)	27.8 (25.3 – 30.4)	0.820	26.8. (25.0 – 28.3)	29.7 (26.1. – 33.1)	0.003
CCI[a]	1 (0 – 2)	0 (0 – 2)	1 (0 – 4)	0.017	1 (0-2)	0 (0-2)	0.161
Short FES-I[b]	7 (7-9)	7 (7 – 8)	8 (7 – 10)	0.005	7 (7-8)	8 (7-9)	0.125
GDS[c]	1.5 (1 - 3)	1 (0 – 3)	2 (1 – 3)	0.222	1 (0-3)	2 (1-4)	0.167
WOMAC Pain[d]	0 (0 –1)	0 (0 – 1)	0 (0 – 3)	0.875	1 (0-3)	0 (0-2)	0.856

5-Chair-rise Test [s]	12.3 (10.4 – 14.8)	12.0 (10.3 – 14.3)	13.4 (11.0 – 14.9)	0.171	12.1 (10.0 – 14.2)	13.4 (10.8 – 16.4)	0.049
Gait speed [m/s]	1.1 (0.9 – 1.2)	1.1 (0.9 – 1.3)	1.0 (0.8 – 1.1)	0.001	1.1 (0.9 – 1.3)	1.0 (0.8 – 1.1)	0.145
Balance [s]	40 (32.2 – 40)	40 (40 – 40)	33.6 (30.3 – 40)	< 0.001	40 (36.5 – 40)	38.3 (30-40)	0.017
PhoneFITT[e]	53 (41 – 64)	54 (40 – 64)	53 (42 – 67)	0.757	48 (33 – 59.3)	62 (47 – 67)	0.001
Household-related	38 (25 – 43)	37 (21 – 43.5)	38 (28.5 – 43)	0.750	28 (16.5 – 38)	43 (38 – 49)	< 0.001
Recreational	18 (13 – 23.5)	18 (12.5 – 22.5)	18 (13.3 – 24.8)	0.775	19 (15 – 25)	17 (10-22)	0.075
Functional limitations[f]	2 (1 – 4)	2 (1 – 3)	3 (2 – 4)	0.009	2 (1-4)	3 (1-3)	0.262
Environmental barriers[g]	57 (51 –66)	56 ((51 – 62)	60.5 (52 – 68)	0.082	56.5 (50-63)	57 (53 – 66)	0.316
P-E fit score[g]	81 (23 – 149)	62 (15 – 119)	134 (70 – 168)	0.009	66 (13.8 – 147.5)	87 (36 – 157)	0.245

*(q1 – q3) represent the interquartile range

** p values were calculated with Mann-Whitney U Test

[a] CCI = Charlson Comorbidity Index, range from 0 – 37; higher score indicate a higher morbidity; [b] Short FES-I = Falls Efficacy Scale International, range from 7 to 28, higher scores indicate a higher fear of falling; [c] GDS = Geriatric depression scale, range from 0 to 15, higher scores indicate more depressive symptoms; [d] WOMAC Pain = Western Ontario and Mac Master Universities osteoarthritis index (sub-scale pain), range from 0 to 50, higher scores indicate more pain; [e] PhoneFITT = physical activity questionnaire, range from 0 – 220, higher scores indicate more physical activity; [f] number of functional limitations and dependence on mobility devices according to the Housing Enabler instrument, range from 0 - 15; [g] number of environmental barriers rated according to the Housing Enabler instrument, range from 0 – 188; [g] range 0 – 2,150, higher scores indicate a greater magnitude of P-E fit problems

Table 2

Characteristics of the housing situation of the participants; total sample, two age groups (< 80 years; 80 years and older) and by sex.

	All (N = 81)	Younger Participants (N = 45)	Older Participants (N = 36)		Men (N = 42)	Women (N = 39)	
	Median, (q1 – q3)*	Median, (q1 – q3)*	Median, (q1 – q3)*	p-value**	Median, (q1 – q3)*	Median, (q1 – q3)*	p-value**
Age of the building [years]	49 (57 – 32)	41 (55 – 28.5)	51 (57 – 40.25)	0.032	45 (54.3 – 31)	51 (60 - 37)	0.154
Number of rooms[a]	3 (3 – 4)	3 (3 – 4.25)	3 (3 – 3.88)	0.327	3 (3 – 4.7)	3 (2.5 – 4)	0.064
Multi-dwelling building [%]	80.2	77.8	83.3	0.535	78.6	81.2	0.696
Home owner [%]	72.8	73.3	72.2	0.912	73.6	71.8	0.840

*(q1 – q3) represent interquartile range

** differences between age groups and sex, respectively, were calculated with the Mann-Whitney U test

[a] kitchen and hygiene rooms not included

Table 3

Bivariate correlation between physical activity and descriptive characteristics, personal and environmental components of P-E fit, and the total P-E fit score; total sample, two age groups (< 80 years; 80 years and older) and sex.

	All participants (N = 81)	Younger participants (N = 45)	Older participants (N = 36)	Male participants (N = 42)	Female participants (N = 39)
Age	- 0.021 (0.851)	0.015 (0.920)	- 0.273 (0.107)	0.128 (0.418)	- 0.160 (0.330)
Short FES-I[a]	- 0.089 (0.429)	- 0.016 (0.916)	- 0.214 (0.210)	0.026 (0.869)	- 0.419 (0.008)
GDS-15[b]	- 0.255 (0.022)	- 0.242 (0.114)	- 0.327 (0.052)	- 0.285 (0.079)	- 0.397 (0.012)
WOMAC[c]	0.015 (0.893)	- 0.012 (0.936)	0.023 (0.887)	- 0.169 (0.281)	0.145 (0.377)
Functional limitations[d]	- 0.245 (0.027)	- 0.058 (0.708)	- 0.513 (0.001)	- 0.213 (0.176)	- 0.524 (0.001)
Environmental barriers[e]	0.049 (0.662)	- 0.123 (0.420)	0.198 (0.247)	0.025 (0.876)	0.031 (0.853)

P-E fit score[f]	- 0.142 (0.208)	0.008 (0.957)	- 0.338 (0.044)	- 0.215 (0.172)	- 0.216 (0.188)

Note: Spearman's rho (r_s) was used for all correlation analyses; values in brackets denote p-values

[a] Short FES-I = Falls Efficacy Scale International, range from 7 to 28, higher scores indicate a higher fear of falling; [b] GDS = Geriatric depression scale, range from 0 to 15, higher scores indicate more depressive symptoms; [c] WOMAC = Western Ontario and Mac Master Universities osteoarthritis index (pain), range from 0 to 50, higher scores indicate more pain; [d] number of functional limitations evaluated by the Housing Enabler instrument ranging from 0 - 15; [e] number of environmental barriers rated according to the Housing Enabler instrument ranging from 0 – 188; [f] range 0 – 2150, higher scores indicate a greater magnitude of P-E fit problems

Table 4

Three binary regression models (Models 1- 3) with physical activity used as the dependent variable and a forth multivariate model (Model 4) with functional limitations and environmental barriers as independent variables. Total sample, two age groups (< 80 years; 80 years and older) and sex.

		All participants (N = 81)		Younger participants (N = 45)		Older participants (N = 36)		Men (N = 42)		Women (N = 39)	
Model		Beta (p-value)	Adjusted r²	Beta (p-value)	Adjusted r²	Beta (p-value)	Adjusted r²	Beta (p-value)	Adjusted r²	Beta (p-value)	Adjusted r”
1	Functional limitations[a]	- 0.282 (0.011)	0.068	- 0.126 (0.408)	-0.007	- 0.468 (0.004)	0.196	- 0.262 (0.094)	0.045	- 0.485 (0.002)	0.215
2	Environmental Barriers[b]	0.067 (0.551)	-0.008	- 0.084 (0.585)	-0.016	0.230 (0.177)	0.025	- 0.026 (0.870)	0.024	0.025 (0.880)	0.026
3	P-E fit score[c]	- 0.226 (0.042)	0.039	- 0.129 (0.399)	-0.006	- 0.369 (0.027)	0.111	- 0.287 (0.065)	0.009	- 0.264 (0.105)	0.044
4	Functional limitations[a]	- 0.294 (0.008)	0.066	- 0.111 (0.591)	-0.029	- 0.438 (0.009)	0.185	- 0.271 (0.090)	0.025	- 0.487 (0.002)	0.195
	Environmental Barriers[b]	0.101 (0.357)		- 0.046 (0.778)		0.114 (0.475)		0.066 (0.667)		0.045 (0.758)	

[a] number of functional limitations and dependence on mobility devices according to the Housing Enabler instrument, ranging from 0 - 15; [b] number of environmental barriers according to the Housing Enabler instrument, ranging from 0 – 188; [c] range 0 – 2150, higher scores indicate a greater magnitude of P-E fit problems