NEIGHBORHOOD ENVIRONMENT AND WALKING FOR TRANSPORT AND RECREATION IN CENTRAL EUROPEAN OLDER ADULTS

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BACKGROUND: Neighborhood environment is an aspect that influences physical activity, mainly walking. Hence, built environment research may help to use environmental and policy strategies to increase physical activity.

OBJECTIVE: This cross-sectional study aimed to investigate the association between perceived neighborhood environment and meeting the recommendation of at least 30 minutes of walking 5 or more days a week within active transportation and leisure-time domains in Central European older adults.

METHODS: Four hundred and fifty six healthy ambulatory older adults filled out the modified and culturally adapted version of the Neighborhood Environment Walkability Scale (ANEWS) for obtaining perceived environment information and the self-administrative long version of the International Physical Activity Questionnaire (IPAQ) for assessing physical activity levels.

RESULTS: Respondents living in high residential density neighborhoods (OR 1.87), living in flats (OR 2.09) and in location with ≤ 100,000 inhabitants (OR 1.63) were more likely to meet recommendation within walking for transportation. Owning a dog was associated with meeting recommendation within walking for leisure (OR 1.69).

CONCLUSIONS: This study supported the specific impact of environment on meeting PA recommendations within transportation and leisure time walking in older adults. Out of all perceived neighborhood environmental attributes received from ANEWS questionnaire, only high residential density was positively associated with meeting recommendation within total walking and walking for transport.

INTRODUCTION

The benefits of walking and its accessibility to all populations, including older adults, are well documented and hence, walking has the potential to have a large public health impact (Lee & Buchner, 2008). Based on the literature reviews (Humpel, Owen, & Leslie, 2002; Owen et al., 2004; Saelens, Sallis, & Frank, 2003), walking (and overall physical activity) was associated with both perceived and objectively determined environmental attributes. Adult study including eleven countries from Asia, Europe and North America suggested that people living in a neighborhood with the most supportive environments were twice as likely to meet physical activity guidelines as those without any supportive features (Sallis et al., 2009). In case of older adults studies, findings from Japan (Takano, Nakamura, & Watanabe, 2002), Canada (Gauvin et al., 2008), Netherlands (Maas, Verheij, Groenewegen, Vries, & Spreeuwenberg, 2006), U.S.A. (Frank, Kerr, Rosenberg, & King, 2010; Nagel, Carlson, Bosworth,

& Michael, 2008) and other countries suggested different results and the need to further investigate this problem. Mainly because built environment research may help to use environmental and policy strategies to increase physical activity (Sallis, 2011).

In Central European conditions, there was only one adults study concerning neighborhood environment and physical activity (Frömel, Mitáš, & Kerr, 2008). Therefore, this cross-sectional study aimed to investigate the association between perceived neighborhood environment and meeting recommendation of at least 30 minutes of walking 5 or more days a week in Central European older adults. As recreation and transportation activity domains seem the most promising intervention targets (Owen et al., 2007), meeting recommendation within walking for transportation and walking for leisure was investigated. Interactive effects of individual and built-environment factors, which were predicted by ecologic models of health behavior (Sallis & Owen, 2002), were confirmed in previous studies (Owen et al., 2007). Hence, this study also aimed to

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examine the associations between BMI, socio-demographical and other individual environmental factors and walking.

METHODS

Participants and setting

Older adults attending University of Third Age programs focusing on healthy lifestyle in the Czech Republic, Poland and Slovakia were offered to participate in the cross-sectional study approved by the Faculty of Physical Culture Ethics Committee at Palacký University in Olomouc. Selected cities within all three states are within the middle European region with very similar cultural, social and built environment. The study was carried out during years 2009–2012. The questionnaire data investigated physical activity during the previous seven days. Weather might influence physical activity in older adults (Belza et al., 2004), thus the data were intentionally collected during moderate spring and autumn seasons having mean temperatures of ≈ 10° C (according to measurements taken four times within 24 hour periods), avoiding warm summers and cold winters. Five hundred and thirty one seniors agreed to participate and gave their verbal and written consent. Data from seventy five participants had to be excluded due to incomplete data records. Hence, four hundred and fifty six healthy ambulatory (able to walk without any prosthetic aids) older adults were included into the data analysis. Out of the total sample, four hundred and two were women (mean body mass index 26.4 ± 4.0 kg/m² and age 64.3 ± 4.5 years) and fifty three were men (mean body mass index 27.5 ± 4.0 kg/m² and age 66.8 ± 5.4 years). State and city detailed characteristics of participants' age and body mass index are shown in TABLE 1.

Measurements

Neighborhood environment

Modified and culturally adapted version of the Neighborhood Environment Walkability Scale (ANEWS) (Cerin, Saelen, Sallis, & Frank, 2006) was used for obtaining perceived environment information. ANEWS is an instrument that assesses the perception of neighborhood design features related to physical activity, including residential density, land use mix (including both indices of proximity and accessibility), street connectivity, infrastructure for walking/cycling, neighborhood aesthetics, traffic and crime safety, and neighborhood satisfaction.

Physical activity

The self-administrative long version of the "International Physical Activity Questionnaire" IPAQ was used to assess physical activity levels. The reliability and validity of the instrument has been tested across 12 countries (Craig et al., 2003). The Czech translated version complied with a standardized translating guidelines including back-translation into English (www.ipaq.ki.se) and was used in previous Czech research (Frömel, Mitáš, & Kerr, 2009; Pelclová, Vašíčková, Frömel, & Djordjević, 2009). Similarly translation of Polish and Slovak version of IPAQ questionnaire followed the afore mentioned standardizing rules. The IPAQ long version investigated walking, moderate PA and vigorous PA in four life domains – work-related (paid jobs, farming, and voluntary job), house and gardening work (outside and inside the home), leisure time (recreational and sport activities) and active transportation domain. In this study with regard to older adult population, only walking with cutoff of 30 minutes five times a week (Haskell et al., 2007) within active transportation and leisure time domain was assessed.

Other data collection

Body mass index (BMI) was calculated based on self-reported weight and height and was categorized as normal (less than 24.9 kg/m²), overweight

TABLE 1

Age and body mass index characteristics of participants according to states and cities

State	City	*n*	Age		BMI (kg/m²)	
			M	**SD**	**M**	**SD**
Czech Republic	Zlín	40	66.5	4.2	26.5	4.5
	Olomouc	119	63.1	4.1	26.3	4.2
	Ústí nad Labem	78	64.1	3.9	27.3	4.7
	Brno	96	65.6	4.9	25.4	3.0
Poland	Katowice	75	65.6	5.4	27.2	3.7
Slovakia	Prešov	48	64.0	4.4	27.2	3.8

Legend: BMI – body mass index, *n* – number of participants, M – mean, SD – standard deviation

(25–29.9 kg/m^2) and obese (more than 30 kg/m^2) (World Health Organization, 1998). Moreover, additional information about owning a dog, bicycle, participation in organized physical activity, size of location, and residential status was obtained from respondents.

Data analysis

The results of physical activity were processed according to the guidelines of the "IPAQ Research Committee" (www.ipaq.ki.se). Data assessing perceived neighborhood environment were processed according to the scale reported in Saelens, Sallis, Black, and Chen (2002).

The statistical package SPSS 18 (SPSS, Inc., Chicago, IL, USA) was used to statistically process the data. Significant levels were set at $p < 0.05$. Binary logistic regression (enter method) was used for dichotomous outcomes – reaching recommendation for walking, walking for transportation and walking for leisure as dependent variables. The independent variables entered into the first model in binary logistic regression were: residential density, land use mix (including both indices of proximity and accessibility), street connectivity, infrastructure for walking/cycling, neighborhood aesthetics, traffic and crime safety. The independent variables entered into the second model in binary logistic regression were – age (split into two groups 55–64, 65+), BMI (< 25, ≥ 25), dog-ownership and ownership of bike (yes, no), residential status (house or flat in large block of flats, having kitchen and 1–4 rooms) and location ($> 100,000$ inhabitants, $< 100,000$ inhabitants). First group in each category was the referent group in each binary logistic regression analysis.

RESULTS

From the total sample, 75.0% of respondents (342 respondents) accomplished the recommended 30 minutes of walking five times a week. 66.4% of respondents (303 respondents) met the walking recommendation within transportation domain and 28.9% of respondents (132 respondents) met the recommendation within walking for leisure.

TABLE 2 presents perceived neighborhood walkability attributes and their influence on recommendation within total walking, walking for transportation and walking for leisure. Respondents living in high residential density neighborhoods were more likely to meet the recommendation within both total walking and walking for transportation. No significant factors associated with meeting recommended values for walking within leisure time domain were found.

TABLE 3 shows influence of BMI, socio-demographic and environmental factors on meeting recommendation within total walking, walking for transportation and walking for leisure. The respondents were more likely to meet walking recommendation if they lived in flat (compared to living in a house). Owning a dog was associated with meeting recommendation within walking for leisure. Respondents living in location with $\leq 100,000$ inhabitants and living in a flat were more likely to accomplish recommendation within walking for transport.

DISCUSSION

In this cross-sectional, descriptive study, the associations between perceived neighborhood environment and meeting recommendation of 30 minutes of walking 5 days a week in middle European older adults were investigated. The participants of this study were more active compared to previous study of randomly selected Czech inhabitants of the same age (Pelclová, Vašíčková, Frömel, & Djordjević, 2009). Even 75% of older adults accomplished the recommendation for walking. Older adults attending the University of the Third Age are probably more active than their counterparts who do not participate in any organized activity for older adults. The high level of physical activity of University of Third Age attendees was already published (Pelclová, Gába, Tlučáková, & Pośpiech, 2012).

The novelty of this study is that environmental attributes were examined in relation to walking in Central Europe in older adults. Moreover, specifically with respect to the age of participants the association between environmental attributes and walking for transport and walking for leisure were investigated. Out of all perceived neighborhood environmental attributes, only high residential density was positively associated with meeting recommendation within total walking and walking for transport. The impact of higher residential density (together with a mixture of land uses and gridline street patterns with short block lengths) on engagement of inhabitants in more walking and cycling trips for transport was indicated in transportation studies (Saelens, Sallis, & Frank, 2003). There were not found any environmental factors associated with meeting walking within walking for recreation in our study. Similarly in the study published by Owen et al. (2007), some attributes of neighborhoods were associated with residents' walking for transport, but not with walking for recreation. Furthermore in a Brazilian study of 6,166 adults, most environmental features were not associated with walking for leisure and personal factors were stronger predictors of walking for leisure as compared with perceived environment factors (Gomes et al., 2011).

TABLE 2

Influence of perceived neighborhood walkability attributes on meeting walking recommendation

Neighborhood walkability attributes	Meeting recommendations					
	5 × 30 min. walking for transport		5 × 30 min. walking for leisure		5 × 30 min. total walking	
	n (%)	OR (CI)	*n* (%)	OR (CI)	*n* (%)	OR (CI)
Residential density						
Low	**76 (55.1)**	**1.87* (1.21–2.89)**	40 (29.0)	1.03 (.65–1.63)	92 (66.7)	**1.81* (1.13–2.89)**
High	**227 (71.4)**		92 (28.9)		**250 (78.6)**	
Land use-mix – proximity						
Low	144 (66.4)	1.02 (.69–1.52)	61 (28.1)	1.10 (.73–1.65)	165 (76.0)	.92 (.60–1.42)
High	159 (66.5)		71 (29.7)		177 (74.1)	
Accessibility						
Low	13 (56.5)	1.29 (.54–3.08)	8 (34.8)	.76 (.31–1.86)	16 (69.6)	1.16 (.46–2.94)
High	290 (67.0)		124 (28.6)		326 (75.3)	
Street connectivity						
Low	8 (57.1)	1.8 (.42–3.88)	5 (35.7)	.72 (.23–2.25)	11 (78.6)	.75 (.20–2.80)
High	295 (66.7)		127 (28.7)		331 (74.9)	
Infrastructure for walking/cycling						
Low	19 (52.8)	1.52 (.74–3.11)	11 (30.6)	.96 (.45–2.07)	25 (69.4)	1.17 (.54–2.54)
High	284 (67.6)		121 (28.8)		317 (75.5)	
Neighborhood aesthetics						
Low	45 (62.5)	1.32 (.78–2.25)	18 (25.0)	1.28 (.72–2.29)	49 (68.1)	1.61 (.92–2.81)
High	258 (67.2)		114 (29.7)		293 (76.3)	
Traffic and crime safety						
Low	32 (57.1)	.74 (.41–1.33)	16 (28.6)	.97 (.51–1.82)	39 (69.6	1.46 (.45–1.61)
High	271 (67.8)		116 (29.0)		303) (75.8)	

Legend: OR – odds ratio, CI – confidence interval, * $p < 0.05$

In this study, personal factors appear to have the influence on meeting walking recommendation as well. Considering BMI, socio-demographic and environmental factors entered into second model of logistic regression, there were found different factors influencing walking for transport and walking for leisure. Living in location with ≤ 100,000 inhabitants and living in a flat were positively associated with accomplishment of recommendation within walking for transport whereas people having a dog were more likely to meet the recommendation within walking for leisure. Regardless of domain specification, meeting walking recommendation was associated with living in a flat. This finding is partly related to above-mentioned residential density findings, because higher residential density is characterized by presence of apartments or condominium (block of flats) with 1–3 or > 4 stories. Hence, the findings regarding these two factors are in consistency. Similar positive association between living in location with ≤ 100,000 inhabitants and meeting walking recommendation within specific Central European conditions was confirmed in women in the Czech adults

TABLE 3
Influence of BMI, socio-demographic and environmental factors on meeting walking recommendation

Factors	Meeting recommendations					
	5 × 30 min. walking for transport		5 × 30 min. walking for leisure		5 × 30 min. total walking	
	n (%)	OR (CI)	*n* (%)	OR (CI)	*n* (%)	OR (CI)
Age						
55–64	158 (62.5)	1.32 (.87–2.00)	75 (29.6)	.91 (.58–1.35)	179 (70.8)	1.55 (.98–2.44)
65–69	145 (71.4)		57 (28.1)		163 (80.3)	
BMI						
< 25	107 (61.8)	1.50 (.99–2.27)	52 (30.1)	.89 (.58–1.35)	124 (71.7)	1.36 (.87–2.12)
≥ 25	196 (69.3)		80 (28.3)		218 (77.0)	
Location						
> 100,000 inhabitants	**155 (61.0)**	**1.63* (1.07–2.47)**	73 (28.7)	1.01 (.67–1.54)	185 (72.8)	1.19 (.76–1.86)
≤ 100,000 inhabitants	**148 (73.3)**		59 (29.2)		157 (77.7)	
Residential status						
Family House	**83 (54.2)**	**2.09* (1.34–3.25)**	43 (28.1)	1.24 (.77–1.98)	103 (67.3)	**1.69* (1.05–2.72)**
Flat	220 (72.6)		89 (29.4)		**239 (78.9)**	
Bicycle						
No	127 (73.0)	.71 (.46–1.10)	53 (30.5)	.86 (.56–1.32)	142 (81.6)	.64 (.39–1.02)
Yes	176 (62.4)		79 (28.0)		200 (70.9)	
Dog						
No	233 (67.3)	1.18 (.71–1.95)	93 (26.9)	**1.69* (1.03–2.78)**	261 (75.4)	1.16 (.68–1.99)
Yes	70 (63.6)		**39 (35.5)**		81 (73.6)	
Organized PA						
No	96 (67.1)	.98 (.63–1.52)	35 (24.5)	1.51 (.95–2.40)	110 (76.9)	.89 (.55–1.43)
Yes	207 (66.1)		97 (31.0)		232 (74.1)	

Legend: OR – odds ratio, CI – confidence interval, * $p < 0.05$

study published by Frömel, Mitáš, and Kerr (2008). The relationship between having a dog and meeting recommendation within walking for leisure was to be expected. For example, dog walkers from Pennsylvania aged 71 to 82 from the Health, Aging and Body Composition Study were more likely to achieve 150 minutes of walking per week and had faster usual and rapid walking speeds than non-dog owners (Thorpe et al., 2006).

Different environmental and other individual specific factors found in this study that were significantly related to either walking for transport or walking for leisure support the hypotheses of domain-specific associations between environments and physical activity published in previous studies in adults (Giles-Corti, Timperio, Bull, & Pikora, 2005; Owen, Humpel, Leslie, Bauman, & Sallis, 2004). This study confirmed the specific impact of environment on meeting physical activity recommendation within transportation and leisure time walking in older adults.

This study has several limitations. One limitation is not randomly selected sample disallowing the over-

all generalization of the study results. Furthermore, a consequence of this is the unbalanced proportion of men and women in this study not allowing gender specification. Moreover, percentage of participants meeting the recommendations compared to randomly selected participants of similarly designed studies (Pelclová, Vašíčková, Frömel, & Djordjević, 2009) is too high. However, the study of 546 community-dwelling older adults from Portland (Nagel, Carlson, Bosworth, & Michael, 2008) suggests that built environment may play significant role particularly in those older adults who are somehow active and is associated with increased levels of activity. While conducting further environmental studies in Central European countries, above-mentioned limitation might be taken into consideration.

CONCLUSION

In conclusion, different environmental and other individual specific factors were found to be significantly related to meeting recommendation within either walking for transport or walking for leisure. Living in location with ≤ 100,000 inhabitants and living in a flat were positively associated with accomplishment of recommendation within walking for transport whereas people having a dog were more likely to meet the recommendation within walking for leisure. Out of all perceived neighborhood environmental attributes received from ANEWS questionnaire, only high residential density was positively associated with meeting recommendation within total walking and walking for transport.

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PODMÍNKY PROSTŘEDÍ A CHŮZE V RÁMCI AKTIVNÍHO TRANSPORTU A VOLNÉHO ČASU U STŘEDOEVROPSKÝCH SENIORŮ
(Souhrn anglického textu)

VÝCHODISKA: Podmínky prostředí jsou jedním z aspektů, které mohou ovlivňovat pohybovou aktivitu, zejména chůzi. Výsledky výzkumu zastavěného prostředí mohou prostřednictvím environmentálních a politických strategií napomoci ke zvyšování pohybové aktivity.

CÍLE: Cílem této průřezové studie bylo zjištění asociací mezi subjektivně vnímanými podmínkami prostředí a plněním doporučení 30 minut chůze pět a vícekrát týdně v rámci aktivního transportu nebo volného času u středoevropských seniorů.

METODIKA: Ke zjištění subjektivně vnímaných podmínek prostředí vyplnilo 456 zdravých seniorů modifikovanou a kulturně přizpůsobenou verzi dotazníku k prostředí Neighborhood Environment Walkability Scale (ANEWS). Ke zjištění úrovně pohybové aktivity byla použita dlouhá verze mezinárodního dotazníku k pohybové aktivitě International Physical Activity Questionnaire (IPAQ).

VÝSLEDKY: Respondenti žijící ve čtvrtích s vysokou sídelní hustotou (OR 1.87), žijící v bytě (OR 2.09) a v místě se ≤ 100,000 obyvateli (OR 1.63) měli větší šanci splnit doporučení k pohybové aktivitě v rámci aktivního transportu. Vlastnictví psa bylo pozitivně asociováno s plněním doporučení v rámci chůze ve volném čase (OR 1.69).

ZÁVĚRY: Tato studie přispěla ke zjištění, že prostředí může mít u seniorů dopad na plnění chodeckého doporučení v rámci aktivního transportu a v rámci chůze v jejich volném čase. Ze všech zkoumaných atributů prostředí z dotazníku ANEWS byla pouze vysoká sídelní hustota pozitivně asociována s plněním doporučení v rámci celkového objemu chůze a v rámci aktivního transportu.

Klíčová slova: IPAQ, ANEWS, pohybová aktivita, sídelní hustota.

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