



Personal, social and environmental correlates of physical activity in adults from Curitiba, Brazil

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ARTICLE INFO

Available online 9 November 2013

Keywords:

Social–ecological model
Physical activity
Leisure
Adults
Moderator

ABSTRACT

Background. Leisure-time physical activity is a complex behavior influenced by factors at multiple levels.

Objective. To examine the associations between intrapersonal, interpersonal, environmental factors and leisure-time walking (LTW) and leisure-time physical activities (LTPA), excluding walking. We also examined the moderating effect of sociodemographic characteristics on these associations.

Methods. A cross-sectional study was conducted with 1461 adults from Curitiba, Brazil (63.7% women). LTW and LTPA were assessed through the *International Physical Activity Questionnaire (IPAQ)*, and a cutoff point of ≥ 150 min/week was used. Associations were examined through multilevel logistic regressions.

Results. LTW was positively associated with self-efficacy, enjoyment, social support from family and friends, presence of public places for leisure and neighborhood esthetics. LTPA was associated with self-efficacy, enjoyment, social support from family and friends, safety from crime and neighborhood esthetics. Safety from crime was a predictor of LTPA among older adults only.

Conclusions. Factors at multiple levels were associated with LTW and LTPA. Interventions to promote LTPA would likely benefit from considering personal, social and environmental factors and different levels of influence.

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Introduction

Leisure-time physical activity (LTPA) is a complex behavior influenced by personal, social, environmental and community factors (Bauman et al., 2012; Sallis et al., 2012). There is a growing interest in identifying factors that may explain LTPA to promote more effective interventions that address this complexity. Intrapersonal factors, such as gender, age, and income, are consistently associated with LTPA both in high and in low and middle-income countries (Bauman et al., 2012; Chen et al., 2011). Furthermore, evidence shows that sociodemographic characteristics are important moderators of LTPA (Rech et al., 2012; Silva et al., 2013). For example, social support for LTPA seems to be more important for subjects over 40 years of age than for younger adults (Silva et al., 2013; Van Dyck et al., 2010). Similarly, it has been suggested that social support for LTPA is more important for people from lower socioeconomic status (Silva et al., 2013).

However, little is known about other intrapersonal (e.g., self-efficacy and satisfaction LTPA), interpersonal (e.g., social support) or environmental (e.g., access to places for LTPA practices, safety from crimes

and esthetics of the neighborhood) correlates of physical activity in populations from low and middle-income countries (Bauman et al., 2012). Wider social inequalities and lack of safety and infrastructure are markedly more prevalent in these countries than in high-income countries. Such characteristics have been linked to higher levels of inactivity (Rech et al., 2012). Studies in Latin America have investigated the independent effects of built and social environment in LTPA but to this date the moderating role of sociodemographic characteristics has not been tested (Hallal et al., 2010; Hino et al., 2011; Parra et al., 2011). The understanding of the association of these factors with LTPA is an important step in the planning and evaluation of interventions focused on promoting LTPA in developing countries (Bauman et al., 2012). Thus, the objective of this study was to examine the association between intrapersonal, interpersonal, environmental factors with leisure-time walking (LTW) and moderate-to-vigorous intensity LTPA excluding walking, and to examine the moderating effect of sociodemographic characteristics on these associations.

Methods

Study design

This study was conducted in Curitiba, a state capital in Southern Brazil, in 2009. The sample was drawn from an area of 500 m around eight public spaces (four parks and four squares), selected according to the neighborhoods' social

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and built environment and family income. Further details about the sampling approach are available in another publication (Rech et al., 2012). The final sample consisted of 1461 adults (≥ 18 years) who had resided in the selected locations for at least one year. The sample size was able to detect odds ratios equal or greater than 1.15 with a power of at least 90% and a significance level of 5%. This study was approved by the Federal University of Pelotas Ethics Committee on Human Research (005/2008).

Outcome variables

LTPA was measured using the leisure-time section of the *International Physical Activity Questionnaire* (IPAQ – long version) (Craig et al., 2003). The frequency (days/week) and duration (min/day) of LTW and other LTPA were analyzed. Individuals were classified as “active” when performing at least 150 min/week of LTW or LTPA. To compute minutes per week of LTPA, minutes of moderate and vigorous physical activities were summed (vigorous-intensity activities were multiplied by two). Although there is no specific recommendation for walking there is convincing evidence showing that individuals who walk between 120 and 180 min/week have clear health benefits (Caspersen and Fulton, 2008). Hence LTW was analyzed separately.

Independent variables

Intrapersonal

Enjoyment was assessed using a scale consisting of six items, three related to LTW and three specific to LTPA, all valid and reliable for Brazilian adults (Rech et al., 2011a). The perception of self-efficacy from LTW and LTPA was assessed by an instrument with five items using dichotomous scale (“not confident = 0” and “very confident = 1”), also valid for the Brazilian population (Rech et al., 2011b). Overall scores for both, enjoyment and self-efficacy were obtained by summing the items. The final scores were later dichotomized using the median.

Interpersonal

Social support was measured with a scale adapted and validated for Brazilian adults (Reis et al., 2011) that also has specific scores for LTW and LTPA. The scales included items on the support received from family and/or friends in the last three months, using a three-point response scale (“never = 0,” “sometimes = 1,” “always = 2”). The scores obtained after summing all items were dichotomized using the median.

Environmental

Characteristics of the neighborhood were evaluated by self-report using the short version of the *Neighborhood Environment Walkability Scale* (NEWS-A) (Cerin et al., 2013) validated for the Brazilian population (Malavasi et al., 2007). This instrument consists of 40 items, including 17 with a five-point ordinal scale and 23 on a four-point ordinal scale. In this study, all response scales were adapted to be dichotomous (“no = 0,” “1 = yes”). This procedure was used previously because it increases clarity and understanding of the population (Amorim et al., 2010). NEWS-A comprises characteristics related to residential density, access to leisure facilities, neighborhood esthetics, and

safety from crime in the neighborhood. Previous studies indicate that these environmental characteristics are associated with LTPA in Brazilian adults (Hino et al., 2011; Rech et al., 2012). For each construct, an overall score was created based on the sum of the items, which was subsequently dichotomized using the median.

Sociodemographic variables

The following sociodemographic variables were included in this study: Gender (male vs. female), age (<40.0 vs. ≥ 40.0 years), marital status (single, widowed, living alone or living with others), body mass index (normal vs. overweight) (Silveira et al., 2005). The socioeconomic status (SES) was determined according to the Brazilian Economic classification (ABEP, 2010). This classification is widely used in Brazilian research and is based on the number of assets within the household (e.g. refrigerators, TV), household characteristics (e.g. number of bathrooms) and the highest educational degree in family (defined as all people living together within the same household). The original measure provides an overall score ranging from zero to 46 which are used to categorize the families into seven SES groups. Due to the lack of variability across of all seven categories in our sample the original SES categories were grouped into three SES levels (high, medium and low).

Data analysis

Frequency distribution was used to describe the sociodemographic variables, LTW and LTPA by gender. Logistic regressions were used to test the association between individual, interpersonal, environmental factors and LTW and LTPA. Because the sample was obtained from eight primary sampling units (Pucci et al., 2012), a multilevel modeling with random intercept was used to consider the clustering effect. In the unadjusted model, each independent variable was included separately, and in the adjusted model, all confounding variables were included. Finally, an interaction term was included in the adjusted model to verify the moderating role of the sociodemographic variables (gender, age, SES) in the association between the independent and outcomes variables. For significant interactions, we displayed the predicted prevalence of individual that meet recommendations to LTW and LTPA. All analyses were performed using STATA 9.2 and the *xtmelogit* command. A significance level of 5% was adopted in all analyses.

Results

Table 1 shows the characteristics of the sample. The study included 1461 individuals aged 18 to 69 years (63.7% women). The sample had more women classified at high SES level (40.5%) and normal weight (53.6%) than men (32.8% and 48.1%, respectively). The prevalence of individuals classified as “active” considering only LTW was 18.2% (95% CI: 14.2 to 22.5%) and was similar between men and women. The prevalence of LTPA, excluding walking, practiced for at least 150 min/week was 18.8%, and higher among men than women (27.5% versus 13.7%; $p < 0.01$).

Table 1
Sample socio-demographic characteristics by gender (Curitiba, Brazil – 2009; n = 1461).

Variables	Categorical	All (n = 1461)		Men (n = 530)		Women (n = 931)		p ^a
		n	%	n	%	n	%	
Age group	18–39.9	604	41.3	238	44.9	366	39.3	0.070
	40–59.9	673	46.1	235	44.3	438	47.0	
	≥ 60	184	12.6	57	10.8	127	13.6	
Socioeconomic status	Low	189	12.9	83	15.7	106	11.4	0.004
	Medium	721	49.3	273	51.5	448	48.1	
	High	551	37.7	174	32.8	377	40.5	
Marital status	Single	622	42.6	221	41.7	401	43.1	0.610
	Married	839	57.4	309	58.3	530	56.9	
Weight status	Normal	754	51.6	255	48.1	499	53.6	0.044
	Overweight	707	48.4	275	51.9	432	46.4	
Walking	≤ 149 min/week	1195	81.8	435	82.1	760	81.6	0.833
	≥ 150 min/week	266	18.2	95	17.9	171	18.4	
MVPA ^b	≤ 149 min/week	1187	81.2	384	72.5	803	86.3	0.001
	≥ 150 min/week	274	18.8	146	27.5	128	13.7	

^a Chi-square test.

^b MVPA: physical activity moderate and vigorous intensity.

Positive associations were observed (Table 2) between LTW and self-efficacy (OR = 1.75; 95% CI: 1.31 to 2.34), enjoyment (OR = 2.78; 95% CI = 2.04 to 3.80), social support from family (OR = 1.66; 95% CI: 1.26 to 2.21) and friends (OR = 1.93; 95% CI: 1.47 to 2.54), access of public places for recreation (OR = 1.35; 95% CI: 1.02 to 1.80) and neighborhood esthetics (OR = 1.63; 95% CI: 1.20 to 2.21). LTPA was associated with self-efficacy (OR = 2.16; 95% CI: 1.56 to 2.99), enjoyment (OR = 2.51; 95% CI: 1.80 to 3.51), social support from family (OR = 2.77; 95% CI: 2.08 to 3.69) and friends (OR = 2.89; 95% CI: 2.18 to 3.85), safety from crimes (OR = 1.36; 95% CI: 1.02 to 1.84) and neighborhood esthetics (OR = 1.36; 95% CI: 1.01 to 1.84).

A total of 48 models were tested to examine the moderating effects of sex, age and SES and only model has shown to be statistically significant. The association between perceived neighborhood safety from crime and LTPA (Fig. 1) was significant only for the age group ≥ 40 years (OR = 1.84; 95% CI: 1.23 to 2.77) but not significant in young people (OR = 0.97; 95% CI: 0.61 to 1.52).

Discussion

The results show that factors at multiple levels (intrapersonal, interpersonal and environmental) are associated with LTW and LTPA in adults from Curitiba, Brazil. To date, we are unaware of similar studies that have considered factors from different levels at influencing LTPA and walking separately in adults living in communities from low and middle-income countries. Interestingly, our findings confirm evidence from high-income countries (Van Dyck et al., 2010) and the assumptions of the ecological model (Sallis et al., 2006, 2012). The findings suggest that the complex aspects that affect LTW and LTPA in high-

income countries are also observed in urban populations in middle-income countries, such as Brazil.

Regarding individual factors, self-efficacy and enjoyment were positively associated with LTW and LTPA and did not vary across sociodemographic characteristics. These results are consistent with the literature showing that higher levels of self-efficacy and enjoyment may help to mitigate perceived barriers and increase the likelihood of engaging in physical activity (Benight and Bandura, 2004; Trost et al., 2002). This finding is confirmed by evidence from cross-sectional studies (Van Dyck et al., 2010) and clinical trials (Dishman et al., 2004; Sallis et al., 1992). Additionally, this finding suggests that confidence in one's own ability is crucial for behavior change (Bandura, 1977; Sallis et al., 1992). Strategies including the use of positive reinforcement of behavior, modeling (e.g. observational learning), self-selected exercise intensity and LTPA preferences may help to increase self-efficacy (Sallis et al., 1992) and to promote greater enjoyment of LTW and LTPA.

We also found that social support from family and friends was associated with LTW and LTPA. These results are in accordance with the literature (Chen et al., 2011; Van Dyck et al., 2010) and highlight the importance of maintaining or increasing social support to promote LTPA in adults (Heath et al., 2012; Silva et al., 2013). In addition, social support has an indirect effect on LTW and LTPA in leisure-time by increasing self-efficacy and satisfaction with LTPA (McNeill et al., 2006). Therefore, strategies that include group activities, community engagement and social interactions between individuals and communities may contribute to promote LTPA in adults of middle-income countries such as Brazil. In fact, community programs and classes as components of a physical activity group have been implemented in Brazil with considerable acceptance and rapid expansion (Reis et al.,

Table 2

Multilevel logistic regression analyses of association between intrapersonal, interpersonal, environment factors and walking and MVPA in leisure-time (Curitiba, Brazil – 2009; n = 1461).

Factors	Walking			MVPA ^a		
	% ^b	Crude OR (95% CI)	Adjusted ^c OR (95% CI)	% ^d	Crude OR (95% CI)	Adjusted ^c OR (95% CI)
<i>Personal</i>						
Self-efficacy						
Low	18.8	1.00	1.00	21.0	1.00	1.00
High	30.4	1.86 (1.40–2.47)	1.75 (1.31–2.34)	36.6	2.17 (1.57–2.98)	2.16 (1.56–2.99)
Enjoyment						
Low	14.3	1.00	1.00	19.5	1.00	1.00
High	32.7	2.95 (2.17–4.01)	2.78 (2.04–3.80)	37.2	2.55 (1.83–3.54)	2.51 (1.80–3.51)
<i>Social</i>						
Social support family						
Low	14.4	1.00	1.00	13.1	1.00	1.00
High	22.6	1.66 (1.26–2.18)	1.66 (1.26–2.21)	31.2	2.80 (2.13–3.70)	2.77 (2.08–3.69)
Social support friends						
Low	14.3	1.00	1.00	12.1	1.00	1.00
High	24.1	1.90 (1.45–2.49)	1.93 (1.47–2.54)	31.4	3.16 (2.51–4.37)	2.89 (2.18–3.85)
<i>Environment</i>						
Residential density						
Low	18.9	1.00	1.00	16.9	1.00	1.00
High	17.5	0.99 (0.73–1.42)	1.01 (0.74–1.38)	20.8	1.28 (0.93–1.76)	1.25 (0.91–1.71)
Access to leisure facilities						
Low	16.4	1.00	1.00	16.9	1.00	1.00
High	19.4	1.36 (1.03–1.80)	1.35 (1.02–1.80)	20.2	1.31 (0.89–1.73)	1.22 (0.92–1.80)
Esthetic						
Low	13.2	1.00	1.00	14.9	1.00	1.00
High	22.0	1.64 (1.21–2.22)	1.63 (1.20–2.21)	22.8	1.36 (1.02–1.84)	1.36 (1.01–1.84)
Safety from crimes						
Low	18.2	1.00	1.00	15.9	1.00	1.00
High	18.4	0.87 (0.65–1.17)	0.90 (0.67–1.22)	22.2	1.35 (1.01–1.82)	1.36 (1.02–1.84)

^a MVPA: physical activity moderate and vigorous intensity.

^b Walking ≥ 150 min/week.

^c Analyses adjusted for gender, age, marital status, socioeconomic status and weight status. Independent variables not adjusted for other independent variables.

^d MVPA ≥ 150 min/week.

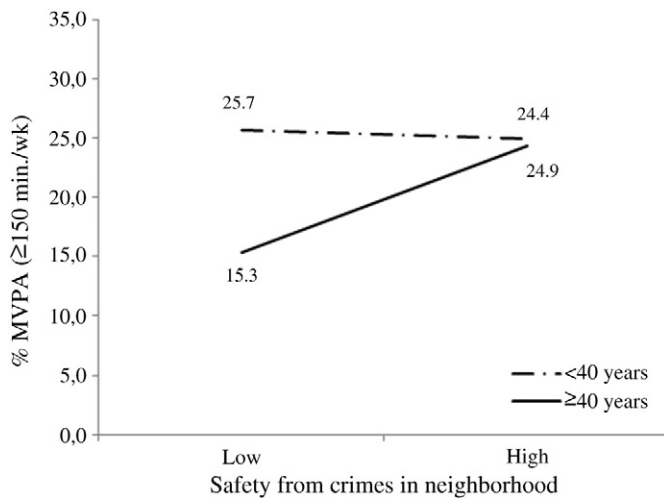


Fig. 1. Prevalence MVPA according safety from crimes in neighborhood and age group in adults. (Curitiba, Brazil – 2009; $n = 1461$). Interaction term between safety from crimes and age group (OR = 1.90; 95% IC: 1.05–3.34; $p < 0.003$).

2010, 2013). This evidence suggests that including group activities (e.g., physical activity classes in community settings) may be an effective strategy to promote physical activity in middle-income countries, such as Brazil.

Favorable perceptions of the environment including factors as neighborhood safety from crimes, esthetics and access to leisure facilities showed a positive association with LTW and LTPA. These results are supported by the literature from high-income countries (Bauman et al., 2012) and also evidence from Latin America (Gomez et al., 2004; Hallal et al., 2010; Hino et al., 2011; Parra et al., 2011). These findings highlight the importance of supportive environments LTPA (Sallis et al., 2006) and emphasize the need to incorporate factors at multiple levels of influence in interventions to promote physical activity (Sallis et al., 2006). These data confirm other evidence that greater access to recreational places, better esthetics and safety can help to unveil the factors affecting promotion of LTPA in countries like Brazil (Hallal et al., 2010; Hino et al., 2011; Rech et al., 2012). Lack of access to recreational facilities may represent a limiting factor for LTPA. Hence, results from another study conducted in Curitiba showed that proximity to gyms and even recreational centers is positively associated with LTPA (Hino et al., 2011). Additionally, access to green and attractive spaces is also associated with LTPA, in Bogotá, Colombia (Gomez et al., 2010).

Finally, the results on moderating effects confirm previous studies and indicate that there are few interactions LTPA and sociodemographic characteristics (Van Dyck et al., 2010). We found that safety from crime is associated with LTPA only among older adults (≥ 40 years). Hence, older individuals may have an increased perception of insecurity in the neighborhood which might prevent them to achieve higher levels of LTPA. Nevertheless, because of the scarcity of findings and the inconsistencies across studies, no conclusive explanation can be given for the moderating effects found in this study. In Brazil, previous studies showed no association between safety from crime and LTPA in adults (Amorim et al., 2010; Gomes et al., 2011). In our sample, when we analyzed the moderating effects, we found an association within a population subgroup. Another study found that the association between perception of safety of walking during the day and walking for leisure-time was significant only among women from the highest SES group (Rech et al., 2012). However, it has been shown that older adults who perceive that it is safe to walk in the neighborhood during the day were 25% more likely to be “active” in leisure-time (Corseuil et al., 2012). Taken together, these findings suggest that older people may be more susceptible to environmental variables (e.g. safety from crimes) than their younger counterparts. Additional research is needed to confirm our findings, as it is important to know whether longitudinal

data and or causal relationships (e.g. interventions) could support what we have found in this study.

The results suggest that interventions to increase LTPA in adults in Curitiba, Brazil are needed. However, these interventions must be implemented as part of an agenda of political and community efforts to address broader approaches, such as ecological models, that account for the complexity of this behavior (Reis et al., 2012). Additionally, there is a need to integrate public health actions aimed at promoting LTPA that include the dissemination of knowledge about correlates of LTW and LTPA, especially in socially vulnerable contexts (e.g., low security). Therefore, more comprehensive interventions, which reach the population at different levels of influence, must be implemented (Bauman et al., 2012). Our findings suggest that psychosocial variables might have greater contribution to LTPA than environmental aspects, though this hypothesis needs to be formally tested in future studies.

This study has a cross-sectional design that limits cause–effect inferences. The sampling design was not intended to represent the entire population of the city of Curitiba, but it had sufficient power to test the hypotheses of the study. The use of multiple interaction tests may increase the chance of type I error in the study. Also, only selected measures of intrapersonal, social and environmental factors were included in the study; other factors might be important as well. The use of measurement scales for intrapersonal and interpersonal aspects specific to the domain of LTPA make the analysis consistent and ensure that perceptions are interpreted for each particular type of physical activity.

We conclude that factors from different levels are associated with LTW and LTPA in Brazilian adults, and an association between neighborhood safety and LTPA was only observed among older adults.

Conflict of interest statement

The authors declare that there are no conflicts of interests.

Acknowledgments

The first author received a scholarship from Foundation Araucaria. The third author (AAFH) received a scholarship from Coordination for Enhancement of Higher Education Personnel (CAPES). This study was funded through CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico – MCT/CNPq 014/2008). The last author is funded by the Wellcome Trust through a New Investigator Award.

The authors thank the members of the Group on Physical Activity and Quality of Life, PUCPR, Curitiba, PR, Brazil for assisting with the data collection and data control.

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