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Perceived Barriers to Leisure-Time Physical Activity in Adults: An Ecological Perspective

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Background: Perceived barriers are modifiable correlates of participation in physical activity. Associations of specific perceived barriers with participation in and level of walking for recreation, and other leisure-time physical activity (LTPA) were examined. Personal, social, and environmental factors associated with these perceived barriers were then examined. ***Methods:*** From 2003 to 2004, 2 surveys collected data on recreational walking and other LTPA, perceived barriers to participation, and personal, social, and environmental attributes, from 2194 Australian adults. Zero-inflated negative binomial regression models examined associations of perceived barriers with walking and other LTPA. Generalized linear models identified the correlates of these perceived barriers. ***Results:*** The perceived barriers of lack of motivation and time were associated with level of LTPA, while lack of motivation, poor health, and lack of facilities were associated with the odds of nonparticipation in LTPA. Personal, social, and environmental factors independently contributed to variations in perceived barriers. ***Conclusions:*** Level and likelihood of participation in LTPA are associated with different perceived barriers. Perceived barriers are a function of both nonmodifiable personal factors and potentially modifiable personal, social, and environmental factors. These findings suggest that the provision of relevant environmental opportunities and social support may effectively reduce perceived barriers to LTPA.

Keywords: ecological model of physical activity; adults; Australia

Regular engagement in physical activity (PA) reduces the risk of a range of chronic diseases.[1] Population surveillance data on PA indicates that a high percentage of adults in developed countries (35% to 75%) are insufficiently active to accrue health benefits.[2,3] Although increasing trends in regular PA participation have been observed in some geographic areas,[3,4] the resulting PA levels are still low (50% to 35%) and remain a public health concern.

A prerequisite for planning effective PA programs and policies is the identification of modifiable factors related to PA participation.[5] Perceived barriers to health-enhancing behaviors are a key construct within major health behavior theories.[6–9] They have been identified as some of the strongest and most consistent correlates of PA, particularly in relation to leisure-time physical activity (LTPA).[5] Physical activity programs and policies that properly address the relevant perceived barriers should be optimally effective in promoting behavioral change. In this context, knowledge of the factors influencing perceived barriers to LTPA is important for the identification of effective intervention pathways.

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In line with ecological models of PA behavior,[10] we hypothesize that as personal, social, and environmental factors shape PA behavior at multiple levels, they also influence perceptions of specific barriers to regular engagement in PA. For example, perceived motivational barriers may be due to lack of enjoyment in LTPA (motivational factor) as well as to inability to access appropriate facilities and insufficient social support.[11] Perceived lack of social support may be influenced by neighborhood safety and access to public facilities through their effect on opportunities for socializing.[12] Time constraints may reflect poor time management skills, but also unavailability of convenient recreational facilities, poor family social support, leisure-unfriendly policies, or inadequate public transport and road infrastructure increasing the time spent commuting and traveling to/from recreational places.[13] Consistent with ecological models, understanding these multiple levels of influence may help develop more-comprehensive and better-targeted interventions or policies to remove barriers to physical activity for different social groups. However, no studies have examined the independent contribution of multilevel personal, social, and environmental factors on specific types of perceived barriers to PA.

Adopting a population- and context-specific ecological perspective to PA,[10] the main aim of this study was to establish the extent to which Australian adults' perceptions of barriers to LTPA are explained by individual (eg, sociodemographics, health status, enjoyment of PA),

social (social support for PA), proximal (home exercise equipment) and distal environmental (objective and perceived neighborhood characteristics) factors potentially salient to the leisure-time domain of PA and an adult population. A secondary aim of this study was to examine the overall (unadjusted for exogenous variables) univariate and multivariate relationships of specific perceived barriers to PA with likelihoods and levels of engagement in leisure-time walking and other forms of LTPA. In doing so, we applied zero-inflated regression models, rarely used in PA research,[14] appropriate for positively skewed data with high frequency of zero values. Importantly, these models can assist the identification of sets of perceived barriers that predict likelihood (ie, participation vs. non participation) versus level of participation in LTPA (in those who regularly engage in LTPA). To our knowledge, this is the first study to address this issue.

Methods

Sample

This paper is based on data from the Physical Activity in Localities and Community Environments (PLACE) study, conducted in 2003 to 2004 in Adelaide, Australia. The study was approved by the Behavioral and Social Sciences Ethics Committee of The University of Queensland.

A sample of 2650 English-speaking residents of private dwellings (age 20 to 65 years) was recruited by mail using a stratified 2-stage cluster sampling design. Households were randomly selected from residential addresses within 32 neighborhoods (including 154 Census Collection Districts; CCDs) identified using Geographic Information Systems methods as either low or high walkable, and stratified as high or low socioeconomic status (SES). Walkability was operationalized as the sum of deciled data on a CCD's residential density, net retail area, street connectivity, and land use mix.[15,16] Neighborhoods with average CCD walkability levels falling in the first and fourth quartiles were considered to be low and high walkable, respectively. Stratification by area SES and walkability was conducted to help maximize the variance of variables that are associated with walkability (eg, infrastructure for walking) and SES (eg, participation in LTPA; automobile ownership; environmental aesthetics). In addition, stratification by SES can increase the representativeness of the sample because, otherwise, high SES respondents tend to be overrepresented.[17] Comparison with Census data corresponding to the sampled neighborhoods showed that respondents were more likely to be female, older, and in paid work ($P < .01$).

Two questionnaires were mailed to the participants including questions about sociodemographic characteristics, perceived environment, psychosocial correlates of LTPA (first questionnaire) and health status (second questionnaire). The overall response rate as a proportion of the total effective sample was 11.5%. Over 74% of those known to be contacted completed the first survey, and 83% of first-survey participants completed the second survey (N = 2194). The sociodemographic characteristics of the participants are reported in Table 1. Details about the sample and recruitment procedure have been reported elsewhere.[15,16]

Measurement

Personal Factors. Participants reported their age, gender, children under 18 in the household, employment status, household size, educational attainment, annual household income, height, and weight (Body Mass Index—BMI was subsequently computed and classified into 'underweight or normal weight' and 'overweight or obese'). *Perceived benefits* of PA were assessed using a validated scale[18] (Cronbach's alpha = 0.94). *Enjoyment* of PA was measured using a modified version of Kendzierski and DeCarlo's[19] scale (Cronbach's alpha = 0.87). Respondents reported weekly hours *spent at work*, *commuting* to and from work, and *on household/gardening activities*. This latter item (household/gardening activities) was from the International Physical Activity Questionnaire (IPAQ).[20] *Mental* and *physical health* statuses were measured using the SF-12,[21] applying weights from the Australian National Health Survey.

Social Factors. *Social support* (2 subscales) for PA was assessed by asking the participants to report the frequency of support received from family and friends on a 5-point scale ranging from *never* to *very often* (Cronbach's alphas: 0.86 and 0.89).[22]

Perceived Environmental Factors. Presence of *home equipment* and *perceived access to facilities* for LTPA were assessed using 2 instruments.[23] Responses on the home-equipment questionnaire were summed to provide the total number of pieces of equipment. Responses on the other questionnaire were recoded into (number of) public open spaces, team-sport facilities, and individual sport/fitness facilities.[24] *Perceived neighborhood environmental characteristics* relevant to LTPA were measured using the Australian version of the Neighborhood Environment Walkability Scale.[25] Data were used on infrastructure for walking; aesthetics and greenery; traffic hazards; crime; and barriers to walking; all rated on a 4-point Likert scale.

Perceived Barriers to PA. These were assessed using Hovell et al's[18] scale (Cronbach's alphas: 0.79 to 0.94). Scores were computed for 8 types of barriers derived from factor analysis: concerns about appearance, bad weather, poor health, lack of motivation, lack of social support, lack of skills/knowledge, lack of facilities, and time constraints. Participants were asked how often these barriers prevented them from getting regular physical activity on a 5-point scale ranging from *never* to *very often.*

Leisure-Time Physical Activity. LTPA was assessed using the long version of the IPAQ.[20] Participants reported the number of days, and average hours and minutes per day of walking for recreation, moderate-intensity, and vigorous-intensity LTPA undertaken in the

Table 1 Sociodemographic Characteristics of the Sample by Neighborhood Type (N = 2194)

Characteristic	HW/HSES	HW/LSES	LW/HSES	LW/LSES
Male, %	36.4	35.6	38.6	32.5
Missing values	0.2	0.0	0.6	0.6
Children in household, %	20.2	28.3	37.2	37.4
Missing values	1.1	1.7	1.4	1.2
Employed, %	71.9	56.3	67.4	47.9
Missing values	1.7	3.1	1.6	2.8
Educational attainment, %				
Year 10 or less	6.1	29.7	20.5	37.2
Year 12 or equivalent	18.2	32.4	31.2	35.3
Tertiary	75.8	36.0	47.0	25.8
Missing values	0.9	1.9	1.3	1.7
Annual household income, %				
<AU$ 31,200	20.6	47.0	21.1	51.6
AU$ 31,200–77,999	42.5	39.3	46.4	36.8
AU$ >77,999	32.7	8.5	30.0	6.7
Missing values	4.2	5.2	2.5	4.9
Age, mean (SD), years	44.4 (12.7)	44.5 (11.9)	47.1 (11.6)	45.7 (11.6)
Missing values, %	1.1	0.8	1.3	0.6
Household size, mean (SD)	2.0 (1.0)	2.2 (1.5)	2.7 (1.2)	2.6 (1.3)
Missing values, %	2.6	3.9	2.8	2.8

Note. This study was conducted in 2003–2004 in Adelaide, Australia.

Abbreviations: HW, high walkable neighborhoods; LW, low walkable neighborhoods; HSES, high socioeconomic status neighborhoods; LSES, low socioeconomic status neighborhoods.

last week. Weekly minutes of each type of LTPA were calculated and weighted by a corresponding multiple of the resting metabolic rate (MET) as specified by Craig et al.[20] Weekly MET-minutes of walking and moderate-to-vigorous LTPA were examined.

Statistical Analyses

To examine associations between perceived barriers and LTPA, zero-inflated negative binomial (ZINB) regression models with robust standard errors accounting for clustering effects were used.[26] Zero-inflated regression models are appropriate for positively skewed data that have a higher frequency of zero values than predicted by a specific distribution, as is the case for PA data.[14] Negative binomial models are preferred to Poisson models in the case of over-dispersion, when the variance of the outcome variable is greater than its mean.[26] Excess zeros and over-dispersion are 2 common characteristics of LTPA data. Zero-inflated regression models are useful in the presence of 2 distinct data-generating processes. The first data-generating process pertains to whether and the extent to which those who usually participate in LTPA actually engaged in LTPA at a given point in time (ie, last week). This process would follow a negative binomial distribution. The second data-generating process differentiates those who engage from those who do not engage in LTPA, the latter representing 'excess' zeros as compared with the expected negative binomial distribution. This process follows a logit probability process. Although the presence of 'excess' zeros does not prove the existence of 2 subpopulations at zero, their presence, supported by theoretical reasoning, can motivate future research on this issue.[14]

Univariate and multivariate ZINB regression models of LTPA as predicted by perceived barriers were estimated. The Vuong test was used to examine whether a zero-inflated model fitted the data significantly better than a standard negative binomial regression model. Antilogarithms of the regression coefficients and their 95% confidence intervals were computed. For the negative binomial regression models of amount of LTPA, these represent the proportional increase (for values > 1.00) or decrease (for values < 1.00) in MET-minutes associated with a unit increase in the predictor. For the 'excess' zero models of participation vs. nonparticipation in LTPA, these represent the odds ratio of being a nonparticipant associated with a unit increase in the predictor.

As scores on perceived barriers were positively skewed, to examine correlates of perceived barriers to PA, generalized linear models with gamma variance and logarithmic link function, and robust standard errors

were used. All explanatory variables were simultaneously entered in the regression models. A probability level of 0.05 was adopted. Analyses were conducted using Stata SE 10.0.

Results

Table 2 shows the results of the ZINB regression models of LTPA with barriers to PA as predictors. All Vuong tests favored the zero-inflated over the standard negative binomial models. Lack of motivation, lack of social support, and time constraints were univariately negatively related to weekly MET-minutes of walking for recreation. All barriers, except for bad weather, were univariately associated with higher odds of being a nonparticipant in recreational walking. When adjusting for other perceived barriers, lack of motivation and time constraints were the only significant predictors of MET-minutes of recreational walking. Poor health, lack of motivation, and lack of facilities were predictive of higher odds, while lack of skills/knowledge was predictive of lower odds of being a nonparticipant in walking.

All perceived barriers were univariately associated with the odds of being a nonparticipant in LTPA other than walking. All perceived barriers but poor health were associated with weekly MET-minutes of moderate-to-vigorous LTPA. Lack of motivation and time were significant predictors of amount of LTPA after adjusting for other barriers. The odds of being a nonparticipant in moderate-to-vigorous LTPA were positively related to poor health, lack of motivation, and lack of facilities. The correlations among perceived barriers ranged from 0.02 to 0.69 (mean = 0.36).

Table 3 reports the results of the regression models explaining each of the perceived barriers to engagement in PA. Personal and environmental factors independently contributed to variations in concerns about appearance, bad weather, and poor health. Personal, social, and environmental factors all contributed significantly to variations in other perceived barriers to LTPA.

Discussion

The aims of this paper were to examine personal, social, and environmental correlates of perceived barriers to engagement in LTPA, and to establish the relationships between specific types of perceived barriers and LTPA. Lack of motivation and time were the most frequently reported[27,28] and the only barriers to independently contribute to variations in amount of weekly LTPA. It is possible that lack of motivation mediated the effects of other barriers on amount of LTPA (of importance: in this study, the associations between lack of motivation and other barriers were moderate, while those of time constraints with other barriers were low). This would explain why barriers that showed a significant univariate relationship with amounts of recreational walking and other LTPA did not independently contribute to their explanation. The fact that motivational barriers were related to 'pure' motivational factors (eg, enjoyment of PA) but also to environmental, social, and health-related factors supports the idea of the mediating role of motivational barriers. In this regard, Burton and colleagues[11] observed that social support may positively affect motivation to exercise. In addition, self-efficacy for LTPA (a concept closely linked to motivation for participation in LTPA) has been found to mediate the effects of social support, health status, and environmental factors on LTPA.[24]

As well as lack of motivation, the barriers of poor health and lack of facilities were positively independently related to the odds of nonparticipation in LTPA. Thus, it is possible that these 2 barriers play a significant role in determining whether someone engages in LTPA, but not in determining the weekly amount of activity in LTPA participants. Similarly, a recent study identified health as a factor related to participation vs. nonparticipation but not level of LTPA.[14] These findings may be due to small variability in health status among those who participate in LTPA. In addition, Heesch and colleagues found that poor health differentiated precontemplators (nonparticipants in LTPA who did not intend to start exercising in the next 6 months) from contemplators (nonparticipants who intended to start exercising).[29] It would seem reasonable that good health and access to facilities, which are often beyond a person's control, are necessary (but not sufficient) conditions for participation in LTPA.[7] Controlling for other perceived barriers, participants considering lack of skills/knowledge to be a barrier for exercise were more likely to participate in recreational walking, likely because it requires no specialized skills or knowledge.

As hypothesized, specific perceived barriers to LTPA were associated with the factor they represent as well as to other factors. For example, motivational barriers were related to motivational, social, and environmental factors. In line with an ecological model of PA behavior,[10] these findings suggest that multilevel interventions targeting situational (eg, availability of places for LTPA) personal (eg, enhancement of time management skills; provision of information on places for LTPA), and social factors (social support for LTPA) are needed to effectively address specific perceived barriers to LTPA. The observed associations of modifiable personal, social and environmental factors with specific perceived barriers to participation in LTPA provide preliminary evidence for potentially effective pathways of intervention. As space constraints do not allow for elaboration on the patterns of associations found for each type of perceived barriers, we will focus on those barriers that, in this study, independently contributed to LTPA.

As observed elsewhere,[27,30] lack of motivation and time were higher in younger, female, and overweight/obese respondents. Two additional sociodemographic characteristics associated with time constraints were income and having a child in the household.[11,31] Most sociodemographic factors cannot be easily modified, but provision of social support and access to locations for exercise may be. Our findings suggest that social support

Table 2 Unadjusted and Adjusted Associations of Perceived Barriers to Physical Activity With Walking for Recreation and With Other Leisure-Time Physical Activity

		Walking for recreation (MET – min wk): M = 393; SD = 648; Mdn = 198; IQR = 495; Zero observations = 859		Moderate-to-vigorous LTPA (MET – min wk): M = 567; SD = 1135; Mdn = 0; IQR = 720; Zero observations = 1287	
Unadjusted associations		**MET – min wk (negative binomial model)[a]**	**OR of being nonparticipant in walking (logit model)[b]**	**MET – min wk (negative binomial model)[a]**	**OR of being nonparticipant in LTPA (logit model)[b]**
Perceived barriers (score range: 0–4)	**M (SD) Mdn (IQR)**	**e^b; $e^{95\% CI}$**	**e^b; $e^{95\% CI}$**	**e^b; $e^{95\% CI}$**	**e^b; $e^{95\% CI}$**
Concern about look	1.07 (1.12) 1.00 (2.00)	1.02; 0.96, 1.09	1.28***; 1.18, 1.39	0.90**; 0.83, 0.97	1.35***; 1.25, 1.47
Bad weather	1.42 (0.98) 2.00 (1.00)	0.99; 0.93, 1.06	1.07; 0.98, 1.18	0.87***; 0.82, 0.94	1.32***; 1.21, 1.44
Poor health	1.07 (0.96) 1.00 (1.00)	1.03; 0.96, 1.10	1.40***; 1.27, 1.54	0.91; 0.83, 1.00	1.54***; 1.40, 1.70
Lack of motivation	1.81 (0.90) 1.75 (1.25)	0.81***; 0.75, 0.87	1.65***; 1.48, 1.84	0.69***; 0.64, 0.74	1.99***; 1.80, 2.21
Lack of social support	1.22 (0.98) 1.00 (1.50)	0.91**; 0.85, 0.98	1.38***; 1.26, 1.51	0.78***; 0.72, 0.85	1.62***; 1.48, 1.76
Lack of skills/knowledge	0.97 (0.96) 1.00 (1.50)	0.96; 0.90, 1.03	1.33***; 1.22, 1.45	0.84***; 0.77, 0.93	1.54***; 1.40, 1.71
Lack of facilities	1.03 (1.01) 1.00 (1.50)	0.99; 0.93, 1.06	1.40***; 1.28, 1.52	0.89*; 0.81, 0.98	1.45***; 1.33, 1.59
Time constraints	2.25 (1.18) 2.00 (1.00)	0.86***; 0.81, 0.91	1.15***; 1.07, 1.24	0.81***; 0.76, 0.85	1.19***; 1.11, 1.27
Adjusted associations					
Poor health		–	1.20***; 1.09, 1.32	–	1.22***; 1.10, 1.36
Lack of motivation		0.86***; 0.79, 0.93	1.49***; 1.32, 1.69	0.73***; 0.67, 0.80	1.77***; 1.58, 1.98
Lack of skills/knowledge		–	0.87*; 0.76, 0.99	–	–
Lack of facilities		–	1.24***; 1.10, 1.40	–	1.10*; 1.01, 1.23
Time constraints		0.90**; 0.84, 0.96	–	0.90***; 0.85, 0.96	–

Abbreviations: LTPA, leisure-time physical activity; M, mean; *SD*, standard deviation; Mdn, median; IQR, interquartile range; wk, week; e^b, antilogarithm of the regression coefficient; $e^{95\% CI}$, antilogarithms of the 95% confidence intervals of the regression coefficient.

Note. Adjusted associations = adjusted for other perceived barriers significantly related to LTPA.

* $P < .05$; ** $P < .01$; *** $P < .001$.

[a] The antilogarithms of the regression coefficients of the negative binomial models represent the proportional increase (if exp(b) > 1.00) or decrease (if exp(b) < 1.00) in weekly MET-min in walking or moderate-to-vigorous LTPA associated with a unit increase in a perceived barrier.

[b] The antilogarithms of the regression coefficients of the logit models represent the proportional increase (if exp(b) > 1.00) or decrease (if exp(b) < 1.00) in odds of being a nonparticipant in walking or moderate-to-vigorous LTPA associated with a unit increase in a perceived barrier.

Table 3 Associations of Personal, Social, and Environmental Factors With Perceived Barriers to Physical Activity

Factor [possible range]	M (SD) or %	Concern about look	Bad weather	Poor health	Lack of motivation	Lack of social support	Lack of skills/ knowledge	Lack of facilities	Time constraints
		e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$
Age	46 (12)	0.988***	0.993***	1.000	0.992***	0.993***	0.997	0.990***	0.992***
		0.983, 0.992	0.990, 0.996	0.995, 1.003	0.990, 0.994	0.991, 0.997	0.993, 1.001	0.986, 0.994	0.990, 0.994
Sex (ref: Male) Female	64%	1.69***	1.06	1.06	1.11***	1.14***	1.17***	1.09	1.19***
		1.51, 1.89	1.00, 1.13	0.97, 1.16	1.07, 1.16	1.06, 1.23	1.07, 1.29	0.99, 1.20	1.13, 1.25
Education (ref: yr 10) Year 12	29%	1.03	0.95	0.99	1.01	1.03	0.91	0.95	0.98
		0.91, 1.17	0.89, 1.04	0.89, 1.09	0.95, 1.07	0.94, 1.13	0.81, 1.02	0.85, 1.06	0.91, 1.05
Tertiary	46%	0.90	0.93	0.98	1.00	0.98	0.85*	0.90	1.04
		0.79, 1.04	0.86, 1.00	0.90, 1.08	0.94, 1.06	0.89, 1.07	0.73, 0.99	0.80, 2.01	0.97, 1.11
Household income ($) (ref: <31.2k) 31.2–80.0k	42%	0.83**	1.01	0.98	1.00	0.93	0.91	0.84**	1.08**
		0.74, 0.95	0.94, 1.08	0.91, 1.07	0.95, 1.05	0.85, 1.02	0.82, 1.02	0.75, 0.94	1.02, 1.15
>80.0k	20%	0.74***	0.94	0.86*	1.05	0.93	0.85*	0.77***	1.13***
		0.62, 0.89	0.86, 1.04	0.76, 0.98	0.99, 1.12	0.82, 1.06	0.73, 0.99	0.66, 0.90	1.05, 1.22
Child(ren) in household (ref: No) Yes	29%	1.16*	1.03	1.02	1.04	1.09*	1.01	1.08	1.21***
		1.03, 1.30	0.96, 1.11	0.94, 1.11	0.99, 1.09	1.01, 1.19	0.92, 1.12	0.98, 1.20	1.16, 1.27
BMI (ref: normal) Overweight/obese	51%	1.38***	1.07*	1.11*	1.13***	1.24***	1.10*	1.11*	1.08***
		1.25, 1.53	1.01, 1.15	1.03, 1.21	1.08, 1.18	1.15, 1.33	1.02, 1.20	1.01, 1.22	1.03, 1.13
Physical health [0–100]	49.4 (9.8)	0.995	1.000	0.969***	0.997***	0.992***	0.996	0.995	1.001
		0.990, 1.000	0.996, 1.003	0.965, 0.973	0.995, 0.999	0.989, 0.996	0.991, 1.001	0.991, 1.000	0.998, 1.003
Mental health [0–100]	49.6 (9.9)	0.989***	0.996*	0.990***	0.994***	0.987***	0.990***	0.991***	0.999
		0.984, 0.994	0.993, 0.999	0.986, 0.994	0.992, 0.996	0.983, 0.990	0.989, 0.994	0.988, 0.995	0.997, 1.001
Benefits of PA [1–5]	4.0 (0.7)	1.12*	1.01	1.03	1.01	1.06	1.01	0.99	1.02
		1.02, 1.22	0.94, 1.07	0.96, 1.10	0.97, 1.04	1.00, 1.13	0.93, 1.11	0.92, 1.07	0.98, 1.07
Enjoyment of PA [1–5]	3.7 (0.9)	0.81***	0.97	0.83***	0.78***	0.80***	0.77***	0.89***	0.95**
		0.75, 0.87	0.92, 1.01	0.78, 0.87	0.75, 0.80	0.76, 0.84	0.72, 0.81	0.84, 0.94	0.92, 0.98
Weekly working hours	25.0 (20.3)	1.003*	0.999	1.000	1.002***	1.001	1.000	1.001	1.007***
		1.001, 1.006	0.997, 1.001	0.998, 1.002	1.001, 1.003	0.999, 1.003	0.997, 1.002	0.999, 1.003	1.006, 1.009

(continued)

Table 3 *(continued)*

Factor [possible range]	M (SD) or %	Concern about look	Bad weather	Poor health	Lack of motivation	Lack of social support	Lack of skills/ knowledge	Lack of facilities	Time constraints
		e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$	e^b $e^{95\% CI}$
Weekly hours spent on household activities	11.1 (14.2)	1.001	0.999	1.002	0.999	1.000	1.005***	1.003	1.000
		0.997, 1.005	0.997, 1.002	1.000, 1.004	0.997, 1.000	0.998, 1.002	1.002, 1.008	1.000, 1.005	0.999, 1.002
Daily hours spent commuting	0.39 (0.71)	0.99	0.97	1.01	1.01	1.00	1.01	1.00	1.04**
		0.92, 1.06	0.93, 1.02	0.96, 1.05	0.98, 1.04	0.96, 1.05	0.94, 1.08	0.94, 1.06	1.00, 1.07
Social support—family [0–4]	1.4 (1.2)	0.98	0.99	1.01	0.97**	0.97*	0.96*	0.95*	1.00
		0.93, 1.03	0.95, 1.02	0.97, 1.05	0.95, 0.99	0.93, 1.00	0.92, 0.99	0.92, 0.99	0.98, 1.02
Social support—friends [0–4]	1.3 (1.2)	0.98	0.99	0.98	0.97***	0.98	0.96	0.92***	0.97**
		0.93, 1.03	0.96, 1.02	0.95, 1.02	0.95, 0.98	0.95, 1.01	0.92, 1.00	0.88, 0.97	0.95, 0.99
Barriers to walking [1–4]	1.3 (0.7)	1.09*	1.06*	1.09***	1.00	1.07**	1.07*	1.08*	1.00
		1.02, 1.16	1.01, 1.11	1.03, 1.15	0.97, 1.02	1.02, 1.13	1.01, 1.13	1.01, 1.14	0.96, 1.03
Infrastructure for walking [1–4]	3.1 (0.6)	0.91*	0.96	1.00	0.95**	0.95	0.93*	0.92*	0.94**
		0.85, 0.99	0.91, 1.01	0.93, 1.07	0.92, 0.98	0.90, 1.01	0.87, 0.99	0.86, 0.99	0.91, 0.98
Aesthetics and greenery [1–4]	3.1 (0.6)	1.01	1.02	0.93	1.02	0.95	0.97	0.86**	1.03
		0.89, 1.14	0.95, 1.10	0.85, 1.02	0.98, 1.06	0.88, 1.05	0.88, 1.07	0.78, 0.95	0.98, 1.09
Traffic hazards[1–4]	2.4 (0.7)	1.09*	1.05	1.11***	1.04**	1.06*	1.14***	1.13***	1.03
		1.01, 1.19	1.00, 1.11	1.05, 1.17	1.02, 1.07	1.01, 1.11	1.06, 1.22	1.05, 1.21	0.99, 1.06
Number of individual-sport facilities [0–13]	4.9 (2.8)	1.00	0.98*	0.98**	0.99*	0.98*	0.97**	0.97***	0.99*
		0.98, 1.02	0.97, 0.99	0.96, 0.99	0.98, 1.00	0.97, 1.00	0.95, 0.99	0.95, 0.98	0.98, 1.00
Home sport/fitness equipment [0–15]	4.3 (2.5)	1.00	1.00	1.01	1.00	0.98	0.98	0.98*	1.00
		0.98, 1.02	0.99, 1.02	1.00, 1.03	0.99, 1.01	0.97, 1.00	0.97, 1.00	0.96, 1.00	0.99, 1.02
CCD walkability [6–40]	16.6 (7.8)	1.000	0.994*	0.995	1.001	0.994*	0.996	0.993*	0.999
		0.992, 1.007	.990, 0.999	0.990, 1.000	0.998, 1.004	0.989, 0.999	0.990, 1.00	0.987, 0.999	0.996, 1.002

Abbreviations: M, mean; SD, standard deviation; yr, year; ref, reference category; CCD, census collection district; e^b, antilogarithm of the regression coefficient; $e^{95\% CI}$, antilogarithms of the 95% confidence intervals of the regression coefficient.

Note. The antilogarithms of the regression coefficients represent the proportional increase (if exp (b) > 1.00) or decrease (if exp (b) < 1.00) on perceived barriers associated with a unit increase in a specific factor. Crime, number of open space locations, and number of team-sport facilities were not significant predictors of any of the barriers examined. Hence, they were excluded from the models.

* $P < .05$; ** $P < .01$; *** $P < .001$.

potentially plays an important role in combating lack of motivation as a barrier to participation in LTPA. It may also help address time constraints by impacting on one's hierarchy of values and priorities. The same may apply to environmental factors. Access to places for walking and to sport facilities were associated with lower levels of time and motivational barriers, and traffic hazards explained additional variance in motivational barriers. While more active people may be more aware of the presence of places for exercise, current evidence on the relationship between the built environment and PA indicates that environmental attributes can impact on the PA behavior.[32–35] Easy access to facilities can minimize the time needed to exercise and motivate participation through the provision of a variety of activity options.[12] The association between lack of time and time spent commuting indicate that other environmental factors, such as urban sprawl, may affect perceived time constraints.[36]Unsurprisingly, perceived lack of facilities as a barrier to LTPA was associated with reported access to sporting facilities and equipment, and neighborhood walkabilty. However, perceived lack of facilities as a barrier was also negatively associated with social support. This indicates that social support may mitigate the perceived negative effects of not having adequate facilities for LTPA. Environmental attributes, especially traffic hazards and physical barriers to walking, were also predictive of poor health as a barrier to participation in LTPA, suggesting that more-walkable environments may help those with health problems maintain an active lifestyle through participation in recreational walking.[37,38]

Study Limitations and Strengths

There are limitations to this study, the first being the use of self-reports to assess environmental characteristics, health factors, BMI, and LTPA. The cross-sectional nature of this study did not permit an analysis of causal effects. The low survey response rate raises concerns about sample representativeness. However, the age- and gender-standardized estimates of prevalence of overweight/obesity and participation in LTPA based on data from this study (50% for overweight/obesity and 69% for participation in LTPA) were comparable to those reported in the 2004 to 2005 Australian National Health Survey (49% and 66%), providing support for the representativeness of the sample.[39] The main strength of this study is the sample size that made it possible to examine associations between a substantial number of factors and perceived barriers to LTPA. It also made it possible to achieve sufficient statistical power to investigate the independent contributions of a sizeable number of moderately correlated perceived barriers to LTPA.

Conclusions

Level and likelihood of participation in LTPA are associated with different types of perceived barriers. While a reduction in motivational and time barriers may help increase the level of LTPA, addressing motivational, health, and environmental barriers may help inactive adults initiate active leisure pursuits. Perceived barriers to LTPA are influenced by nonmodifiable sociodemographic factors but also by modifiable personal, social, and environmental factors. The personal factor of enjoyment in PA is the strongest correlate of perceived barriers to LTPA. This suggests that physical activity programs aiming to allow people to experience the "fun" aspects of activity may be effective in lowering barriers. However, enjoyment in PA is less amenable to change than are environmental attributes and social support because it is likely determined by genetic factors and personal history[40,41] and may optimally require interventions in earlier stages of life. This study suggests that, among a range of modifiable factors, the provision of an activity-friendly environments and the promotion of social support may be the most effective ways of reducing perceived barriers to LTPA in adults at a population level, which should lead to increases in LTPA.[42]

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