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Initiating and maintaining recreational walking: A longitudinal study on the influence of neighborhood green space

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ABSTRACT

Objective. This study examined prospective relationships of green space attributes with adults initiating or maintaining recreational walking.

Methods. Postal surveys were completed by 1036 adults living in Adelaide, Australia, at baseline (two time points in 2003–04) and follow-up (2007–08). Initiating or maintaining recreational walking was determined using self-reported walking frequency. Green space attributes examined were perceived presence, quality, proximity, and the objectively measured area (total and largest) and number of green spaces within a 1.6 km buffer drawn from the center of each study neighborhood. Multilevel regression analyses examined the odds of initiating or maintaining walking separately for each green space attribute.

Results. At baseline, participants were categorized into non-regular (n = 395), regular (n = 286), and irregular walkers (n = 313). Among non-regular walkers, 30% had initiated walking, while 70% of regular walkers had maintained walking at follow-up. No green space attributes were associated with initiating walking. However, positive perceptions of the presence of and proximity to green spaces and the total and largest areas of green space were significantly associated with a higher likelihood of walking maintenance over four years.

Conclusion. Neighborhood green spaces may not assist adults to initiate walking, but their presence and proximity may facilitate them to maintain recreational walking over time.

Introduction

Participation in regular, moderate-intensity physical activity confers significant health benefit (Garber et al., 2011). For adults, walking is the major focus of physical activity promotion initiatives, because of its known health benefits and its acceptability for a high proportion of the population (Lee and Buchner, 2008; Murtagh et al., 2010). Neighborhood environmental attributes, particularly aesthetic and natural features, are associated with recreational walking (Owen et al., 2004; Sugiyama et al., 2012). Neighborhood green spaces such as parks and playgrounds are important recreational resources, both as walkable destinations and as settings in which walking takes place for local residents (Bedimo-Rung et al., 2005). Cross-sectional studies have consistently shown certain attributes of such neighborhood green spaces (size, proximity, and attractiveness) to be associated with adults' walking for recreation (Giles-Corti et al., 2005; Sugiyama et al., 2010). There are several longitudinal studies that have examined the relationships of environmental attributes with the change in the amount of physical activity (Dawson et al., 2007; Humpel et al., 2004; Shimura et al., 2012). However, few studies have investigated how attributes of neighborhood environments are associated prospectively with the initiation or maintenance of recreational walking, with the exception of one Australian study that has shown satisfaction with the quality of neighborhood parks to be positively associated with high levels of walking (maintained over two years) by mothers of young children (Cleland et al., 2008). This study used four-year longitudinal data to examine the relationships of perceived and objectively measured green space attributes with adults' initiation and maintenance of recreational walking.

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Methods

Data source

Data from the Physical Activity in Localities and Community (PLACE) study conducted in Adelaide (population: 1.1 million) were used. The aim of the PLACE study was to examine the associations between built environment attributes, in particular neighborhood walkability, and adult physical activity. Residential addresses were randomly selected from 32 neighborhoods within Adelaide. These neighborhoods were chosen from the top and bottom quartiles of walkability, in order to maximize variability in environmental attributes that may be related to physical activity. Walkability is a composite index consisting of residential density, intersection density, land use mix, and net retail area ratio, which were derived using Geographic Information Systems (GIS) (Leslie et al., 2007).

Baseline data were collected in 2003–04 (Survey 1) and 6 months later (Survey 2). Two surveys (with the core questions on physical activity) were needed to cover a broad range of topics that the PLACE study aimed to investigate. The number of participants who responded to both Survey 1 and Survey 2 was 2194. The baseline response rate, as a proportion of all the households initially identified, was 11.5%. Four years after Survey 1, those who responded to both Surveys 1 and 2 were asked to participate in a follow-up survey (Survey 3, 2007–08), and 1036 returned the survey. The Behavioural and Social Sciences Ethics Committee of the University of Queensland approved the study.

Outcome variables

Initiating or maintaining recreational walking was derived from the frequency of recreational walking, assessed by the same question ("during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?") at three time points. As Survey 1 and Survey 2 were only six months apart, they were considered to constitute the baseline. Participants who reported walking for recreation one day/week or less both at Survey 1 and 2 were classified as "non-regular walkers" at baseline, and those who reported two days/week or more at both surveys were classified as "regular walkers" at baseline. Those who were not consistent in their frequency of recreational walking in Surveys 1 and 2 (e.g., 0 day/week in Survey 1 and 5 days/week in Survey 2) were classified as "irregular walkers", and removed from analysis, as it was difficult to judge their walking change status. Among the non-regular walkers at baseline, those who reported walking one day/week or less at Survey 3 were categorized as "no walking", and those who reported walking two days/week or more at Survey 3 were classified as having "initiated walking". The regular walkers at baseline were classified in the same way as having "stopped walking" (one day/week or less at Survey 3) or "maintained walking" (two days/week or more at Survey 3). Table 1 summarizes the criteria used to determine these walking change categories and shows the number of participants in each category.

Exposure variables

The exposure variables were perceived attributes of neighborhood green spaces (presence, quality, and proximity) and GIS-derived size and number of green spaces. For the perceived presence of green space, participants' response (4-point Likert scale, ranging from 1 = strongly disagree to 4 = strongly agree) to the statement "There is a park or nature reserve in my local area that is easily accessible" was used. For the quality score, their answer to "There are pleasant natural features in my local area" was used (the same response format as above). To determine perceived proximity, participants were asked "How long would it take to get from your home to the nearest parks or natural reserves?", and the response (1: 1–5 min, 2: 6–10 min, 3: 11–20 min, 4: 21–30 min, 5: 30+ min) was coded reversely, so that a larger score corresponded to closer proximity.

The objectively measured green space attributes were the size and number of recreational green spaces that existed within a 1600 m buffer ("crow-fly" buffer) drawn from the center of each of the 32 study neighborhoods. All green spaces larger than 500 m^2, which can include smaller pocket parks, and within or intersected by the boundary were included. Accessible green spaces used for recreational purposes were identified from local maps. Inaccessible spaces (e.g., private or fenced) such as golf courses, race courses, and marsh land were excluded. For each neighborhood, the total area of green spaces and the number of green spaces were identified. As previous studies have found the presence of a large park nearby to be relevant to recreational walking (Giles-Corti et al., 2005; Sugiyama et al., 2010), the size of the largest park within the buffer area was also used as an exposure variable.

Covariates

Covariates considered for the study were socio-demographic variables (gender, age, education, work status, marital status, having child in the household, and income), BMI (calculated from self-reported height and weight), and behavioral variables (walking for transport, TV viewing time). Daily duration of walking for transport was calculated using the International Physical Activity Questionnaire. TV viewing, which is as a major competing activity during leisure time, was assessed using the previously validated questions (Salmon et al., 2003). Six study neighborhoods were bounded by the sea. As the buffer area for these neighborhoods included a smaller land area, an index about whether the neighborhood was adjacent to the sea or not was used to adjust for the difference in the land area. Psychosocial variables relevant to physical activity were also measured as they may influence people's decision on starting or stopping walking. Self-efficacy, enjoyment, perceived benefits, perceived barriers, support from family, and support from friends in relation to moderate physical activity were each assessed using a single item on a five-point Likert-type scale. More detailed methods to identify these variables have been described elsewhere (Janssen et al., 2010). All the covariates were measured at the baseline (Survey 1), except for work status, which was categorized into not working, started working, quit working, and kept working, using the baseline and follow-up data.

Analyses

Logistic regression models examined the odds of initiating recreational walking (among non-regular walkers at baseline) and the odds of maintaining recreational walking (among regular walkers) for each green space attribute. Multilevel analysis was employed with neighborhood as the area-level unit of analysis. Analyses adjusted for gender, age, and other covariates associated with the exposure categories at $p < 0.2$ in univariate analysis (work status, marital status, walking for transport, and TV viewing time). For objectively measured green space attributes, models also adjusted for the index of bounded by the sea. Further analyses adjusting for the psychosocial variables were also conducted for the attributes that were significantly associated with the outcome. The odds ratios reported are for each unit change in the exposure measures (linear associations were assumed, given the lack of studies examining the shape of relationships between physical activity and environmental attributes). Data were analyzed in 2012 using Stata 12 (Stata Corp, College Station, Texas).

Table 1
Criteria for the walking change categories, applied to the data collected in Adelaide, Australia (from 2003–04 to 2007–08).

Walking frequency at baseline[a]	Baseline category	Walking frequency at follow-up[b]	Walking change category	n
1 day/wk or less for both Surveys 1 & 2	Non-regular walker	1 day/wk or less	No walking	279
		2 days/wk or more	Initiated walking	116
2 days/wk or more for both Surveys 1 & 2	Regular walker	1 day/wk or less	Stopped walking	85
		2 days/wk or more	Maintained walking	201
Inconsistent frequency for Surveys 1 and 2	Irregular walker	–	(No category assigned)	313

[a] Survey 1 (2003–04), Survey 2 (6 months after Survey 1).
[b] Survey 3 (4 years after Survey 1).