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Longitudinal associations with changes in outdoor recreation area use for physical activity during a community-based intervention

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Abstract

Outdoor recreation areas (ORA) are important resources for physical activity (PA) and health promotion. While past research has identified correlates of ORA use, few studies have examined predictors of longitudinal changes in park- and trail-based PA in community settings. Using data from a 6-month community-based walking intervention study, we examined cross-sectional and longitudinal predictors of PA in ORAs. Data were collected from baseline and 6-month assessments from participants (n=295) in a group walking intervention in South Carolina; participants enrolled from January 2012-May 2013. A decomposition scheme was used to examine the cross-sectional and longitudinal predictors of average group ORA use for PA, including social support, self-efficacy for PA, perceptions of neighborhood environment, and accelerometer-based PA, adjusting for gender. On average, participants were 49.4±13.3 years old, 66.1% were Black, and the majority were women. There was a mean increase in group ORA use of 2.1±0.4 days/month from baseline to 6 months. Cross-sectionally, higher levels of the percentage of time in MVPA, self-efficacy, and social support were associated with greater group-average ORA use. Longitudinally, increased social support from friends and rating of lighter motorized traffic were associated with increased group ORA use. Additionally, longitudinal increases in percentage of MVPA and more favorable rating of the neighborhood as a place to walk were both associated with decreased group ORA use. Better understanding how social and physical environmental characteristics impact ORA use for PA can lead to more effective intervention strategies and warrants greater attention in future research and public health promotion efforts.

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Keywords

parks; outdoor recreation area; physical activity; built environment

INTRODUCTION

Physical activity (PA) can help prevent and control many chronic diseases, yet levels of PA remain low among U.S. adults (Powell et al., 2011, Troiano et al., 2008). National plans, such as Healthy People 2020 and the National Physical Activity Plan, call for specific actions to increase PA among all age groups, including improving environmental supports for PA(Pate, 2009, U.S. Department of Health and Human Services, 2012). Outdoor recreation areas (ORAs; e.g., parks, trails, green spaces) are associated with greater PA in community-dwelling adults and provide a low-cost resource for PA (Kaczynski and Henderson, 2008, Sallis et al., 2012). Past cross-sectional research on parks has found that ORA-related factors such as proximity, park features, quality, and safety, are associated with ORA use (Carlson et al., 2010, Kaczynski and Henderson, 2008, Kaczynski et al., 2008, Schoffman et al., 2014). However, little is known about longitudinal patterns of ORA use and what factors predict changes in use of these spaces specifically for PA. Therefore, the present analysis examines individual and neighborhood-level predictors that explain changes over a 6-month period in ORA use for PA.

METHODS

Setting and Participants

Data were collected from a 6-month, group-based walking intervention for adults that occurred in a central South Carolina county (pop. 108,052) (U.S. Census Bureau, 2010). Participants were recruited from the community through a variety of methods (e.g., local newspapers) and enrolled from January 2012 to May 2013. Further information about eligibility criteria and sampling have been published previously (Wilcox et al., 2014). The study was approved by the Institutional Review Board at the University of South Carolina. In conjunction with the intervention, participants received maps of ORAs in the county. Anthropometric measures and paper-based questionnaires were collected from participants at enrollment (baseline) and 6 months thereafter. This paper uses data from 295 participants from 55 walking groups with baseline data.

Measures

Use of outdoor recreational areas.—At both baseline and 6 months, participants reported the number of days in a typical month that they used ORAs in the county for PA that are: (1) trails, tracks, or mapped paths, and (2) any other public parks or other ORAs.

Sociodemographic/Weight status.—Participants reported their baseline age, gender, ethnicity, race, education level, and marital status. Height and weight were measured at baseline and body mass index (BMI) was calculated as kg/m^2.

Seasonality.—A four-level variable to capture the season in which a participant's baseline and 6-month visits occurred was coded as follows: winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November).

Self-efficacy and social support.—At baseline and 6 months, a 5-item Self-Efficacy for Exercise Scale assessed participants' confidence in their ability to exercise in a variety of conditions (Marcus et al., 1992). A 14-item version of the Social Support for Exercise Scale separately assessed the level of support participants perceived for their exercise behaviors from each of three sources: family, friends, and walking group (Sallis et al., 1987).

Physical activity.—Total PA, moderate- to vigorous-intensity PA (MVPA), and light PA were assessed objectively at baseline and 6 months using an average of five days of accelerometer data using standard cutpoints (Troiano et al., 2008). Ten hours of wear-time were required for classification as a complete day.

Environmental factors and supports for physical activity.—A composite score from the previously-validated International Physical Activity Questionnaire Environment Module was used to capture perceptions of seven neighborhood attributes at baseline and 6 months (Sallis et al., 2009). Additionally, seven items originally developed by the University of South Carolina Prevention Research Center were used to assess additional environmental characteristics that could impact PA (e.g., rating of quality of street lighting) at baseline and 6 months (Kirtland et al., 2003).

Analysis

Multilevel models were used to examine change in ORA use at the walking group level. An initial random coefficient model examined associations between individual-level variables (i.e., demographics, season) and average group ORA use. Only gender was significantly associated with ORA use; therefore, all subsequent models controlled for gender.

A decomposition scheme was used to estimate cross-sectional and longitudinal effects on group ORA use (Laska et al., 2012). This approach allows for the simultaneous estimation of cross-sectional and longitudinal effects in a single model, and allows for an interpretation in terms of change in independent variables predicting change in dependent variables (Laska et al., 2012). A cross-sectional component averaged baseline and 6-month values. When only one time point was available, that value was used as the mean. A longitudinal component was created as the deviation between the mean and the value at each time point. There was 36% attrition from baseline to the 6-month visit; 194 participants provided data at the 6-month timepoint. There was a negligible amount of item-level missing data across the surveys. Of note, there were a few instances of missing data at one timepoint: missing ORA use (n=2 at baseline, n=6 at 6 months), unusable Actigraph data (n=4 at baseline, n=7 at 6 months), and missing BMI values (n=0 at baseline, n=4 at 6 months). When individuals had at least one timepoint (baseline or 6 months) of data, they were retained in the model for that variable; otherwise they were excluded (Laska et al., 2012).

Separate multilevel random coefficient models examined relationships between each independent variable and average group ORA use, adjusting for gender. Each model estimated the cross-sectional and longitudinal differences in ORA associated with a one-unit difference in the independent variable.

RESULTS

Descriptive characteristics of the sample are shown in Table 1. On average, participants were 49.4±13.3 years of age, with some college education (78.3%), two-thirds (66.1%) were Black, and the majority were women (85.7%). There was a mean increase in group ORA use of 2.1±0.4 days/month from baseline to 6 months. As shown in Table 2, cross-sectionally, higher levels of the following predictors were associated with greater group average ORA use: percentage of time in MVPA, self-efficacy, social support from family, friends, and walking group. Longitudinally, increased social support from friends and rating of lighter motorized traffic (marginally significant) were associated with increased group ORA use. Additionally, longitudinal increases in the percentage of time spent in MVPA and more favorable rating of the neighborhood as a place to walk were both associated with decreased group ORA use.

DISCUSSION

We tested a range of individual and environmental characteristics to examine associations with use of ORAs for PA both cross-sectionally and longitudinally. The findings of this analysis expand our understanding of factors related to active ORA use in several ways. For example, self-efficacy and social support from family, friends, and walking group were cross-sectionally associated with higher average group ORA use, although only social support from friends was longitudinally associated with increased ORA use. The cross-sectional findings about self-efficacy are consistent with past research on overall PA participation (Bauman et al., 2012), but also add to a growing literature on relationships between psychosocial attributes and use of environmental resources for PA (Carlson et al., 2012). Some research shows that positive neighborhood environments especially benefit those with lower self-efficacy and other similar at-risk populations (Kaczynski et al., 2012; Lee et al., 2007) and that parks provide appealing venues for PA (Hansmann et al., 2007), but more research is needed to better understand how opportunities for use of ORAs may mitigate individuals' self-efficacy constraints (Voorhees et al., 2011).

The strong findings relating social support and active ORA use may be reflective of the group-based nature of the present intervention, but are also in line with previous research showing greater park usage and PA within areas possessing higher levels of social capital (Broyles et al., 2011). Further, the cross-sectional findings linking social support and ORA use in the current study align with previous data indicating that women reported higher perceived support for PA intentions, and feelings of safety and enjoyment when they visited ORAs with others (Krenichyn, 2004). This indicates that a bidirectional relationship between ORA use and perceived support for PA may exist, such that ORA use may increase perceived support for PA. Future interventions should build on and leverage the potential for social participation and support for PA within ORA settings. Additionally, walking groups

were comprised of diverse groups of people, some including friends, neighbors, coworkers, and potentially more distant acquaintances. A potential area for further investigation might be to more closely measure the composition of the walking group, and then compare the levels of perceived social support experienced by participants.

Cross-sectional MVPA was associated with ORA use, similar to the findings of other studies that have shown that higher levels of ORA use are correlated with higher levels of PA (Kaczynski and Henderson, 2008, Sallis et al., 2012). However, it is surprising that longitudinal increases in time spent in MVPA were associated with a decrease in group ORA use. Perhaps participants and groups who increased their MVPA during the study were engaging in more vigorous activities than could be accomplished within the available ORAs and with walking groups. Indeed, much park use is observed as sedentary (Kaczynski et al., 2011) and interventions are needed within parks to encourage shifting some inactive behavior to PA (Kaczynski et al., 2014b). In addition, the intervention strategies that comprised this study encouraged participants to participate in PA in a variety of contexts, including but not limited to, ORAs (Wilcox et al., 2014). It is possible that the walking groups collectively decided that other locations (e.g., neighborhood streets, school facilities) were more suitable for their walking sessions in terms of distance, accessibility, or safety compared to the ORAs. Future research could include the wear of geographic positioning system (GPS) devices in addition to the accelerometers to better assess the specific location and contexts of participants' PA (Evenson et al., 2013).Similarly, negative perceptions of safety in ORAs like parks have been frequently cited as a barrier for visitation and physical activity behaviors in such settings (Bai et al., 2013). The group-based component of the intervention inherently includes a strong social component to facilitating PA. It is possible that any negative perceptions about park and recreation locations could have been shared in the group setting and negatively influenced PA in ORA settings over time. Assessing perceptions of safety and other factor affecting ORA use in the future may provide better insight in explaining this longitudinal relationship.

Previous cross-sectional research has found that perceptions of the neighborhood environment, including its safety and accessibility for engaging in PA, is associated with park and trail use (Paxton et al., 2005). However, examination of these factors produced mixed results in our study. For example, we found no association (cross-sectional or longitudinal) between availability of sidewalks and ORA use or rating of quality of street lighting and ORA use. At the same time, ratings of lighter motorized traffic were marginally related to increased ORA use, which is consistent with past research about neighborhood traffic speed and park visitation among adults (Kaczynski et al., 2014a). However, rating one's neighborhood as a pleasant place to walk was related to decreased ORA use over time, which may simply represent a displacement of PA from parks and trails to other neighborhood settings (e.g., sidewalks, streets).

This study relied primarily on self-reported measures of ORA use and influencing factors, but examined a range of personal and neighborhood-level predictors of both cross-sectional and longitudinal ORA use within a racially-diverse sample. Better understanding how social and physical environmental characteristics impact ORA use for PA can lead to more

effective intervention strategies and warrants greater individual and collective attention in future research and public health promotion efforts.

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Table 1:

Descriptive characteristics of sample at baseline

Characteristic	Total sample (n=295) Mean (SD) or %
Age (years)	49.4 (13.3)
Gender	
Male	12.9
Female	85.7
Race (%)	
Black/African American	66.1
White	30.1
Other/Unknown	3.8
BMI (kg/m^2)	31.6 (6.4)
Education (%)	
High School diploma or less	21.8
Some college or more	78.2
Marital Status (%)	
Married/Cohabitating	56.3
Not Married	43.7
ORA Use (average days/ month)	
Baseline	3.9 (5.4)
6-months	6.0 (6.3)
% MVPA[1]	2.0
% sedentary[1]	62.5
Self-efficacy[2]	4.1 (1.5)
Perception of PA in neighborhood[3]	2.4 (0.7)
Rating of neighborhood as place to walk[4]	1.7 (0.8)
Rating of motorized traffic in neighborhood[5]	2.2 (0.7)
Availability of sidewalks (% yes)	19.8
Rating of quality of street lighting[6]	3.7 (1.2)
Length at current address (years)	13.7 (12.3)
Social support, family[7]	2.5 (0.8)
Social support, friends[7]	2.5 (0.7)
Social support, group[7]	2.2 (0.8)

[1] Percentage of time in moderate-to-vigorous physical activity, based on daily average over a week

[2] Scores range from 1 to 7 (not at all confident to very confident)

[3] Scores range from 1 to 4 (very active to not at all active)

[4] Scores range from 1 to 4 (very pleasant to not at all pleasant)

[5] Scores range from 1 to 3 (heavy to light)

[6] Scores range from 1 to 5 (very well maintained to not at all maintained)

[7] Scores range from 1 to 5 (none to very often)

Table 2:

Cross-sectional and longitudinal associations between physical environment, social environment, and psychosocial factors and days/month of ORA use for physical activity[1]

	Cross-Sectional			Longitudinal		
	Coefficient	**SE**	**p**	**Coefficient**	**SE**	**p**
BMI	0.01	0.04	0.88	0.09	0.28	0.75
% weekly MVPA	**0.46**	**0.17**	**0.007**	**−0.65**	**0.22**	**0.004**
% weekly sedentary	−0.03	0.03	0.26	0.01	0.04	0.73
Self-efficacy	**0.95**	**0.21**	**<0.001**	0.07	0.29	0.82
Perception of PA in neighborhood	−0.30	0.46	0.52	−0.11	0.58	0.84
Rating of neighborhood as place to walk	0.16	0.39	0.68	**−1.68**	**0.58**	**0.004**
Rating of motorized traffic in neighborhood	0.15	0.48	0.76	1.27	0.9	0.068
Availability of sidewalks	0.22	0.79	0.78	2.58	1.65	0.12
Rating of quality of street lighting	−0.01	0.28	0.96	−0.44	0.45	0.33
Length at current address	−0.03	0.02	0.17	−0.01	0.09	0.92
Social support, family	**1.28**	**0.38**	**<0.001**	0.85	0.55	0.12
Social support, friends	**1.80**	**0.44**	**<0.001**	**1.27**	**0.54**	**0.02**
Social support, group	**1.42**	**0.44**	**0.002**	0.44	0.42	0.30

[1]Note: all analyses adjusted for gender