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Interactions between psychosocial and built environment factors in explaining older adults' physical activity

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ABSTRACT

Objective. To evaluate ecological model predictions of cross-level interactions among psychosocial and environmental correlates of physical activity in 719 community-dwelling older adults in the Baltimore, Maryland and Seattle, Washington areas during 2005–2008.

Method. Walkability, access to parks and recreation facilities and moderate-to-vigorous physical activity (MVPA) minutes per week (min/week) were measured objectively. Neighborhood aesthetics, walking facilities, social support, self-efficacy, barriers and transportation and leisure walking min/week were self-reported.

Results. Walkability interacted with social support in explaining total MVPA ($B = 13.71$) and with social support ($B = 7.90$), self-efficacy ($B = 7.66$) and barriers ($B = -8.26$) in explaining walking for transportation. Aesthetics interacted with barriers in explaining total MVPA ($B = -12.20$) and walking facilities interacted with self-efficacy in explaining walking for leisure ($B = -10.88$; $Ps < .05$). Summarizing across the interactions, living in a supportive environment (vs. unsupportive) was related to 30–59 more min/week of physical activity for participants with more positive psychosocial attributes, but only 0–28 more min/week for participants with less positive psychosocial attributes.

Conclusion. Results supported synergistic interactions between built environment and psychosocial factors in explaining physical activity among older adults. Findings suggest multilevel interventions may be most effective in increasing physical activity.

Physical activity is particularly important among older adults, who represent the least active population group yet can benefit greatly from increasing activity levels (Nelson et al., 2007; Troiano et al., 2008; USDHHS, 2008). Physical activity interventions in older adults often focus on changing psychosocial skills, barriers, self-efficacy and social support (Kahn et al., 2002; King et al., 1998; Marcus et al., 2006). Yet, built environment factors such as walkability and parks are also related to older adults' physical activity (Frank et al., 2010a; Yen et al., 2009; Hall and McAuley, 2010; Clarke and Nieuwenhuijsen, 2009; van Cauwenberg et al., 2010). Older adults may be particularly susceptible to built environment influences because they may prefer shorter walking distances, require safe pedestrian facilities, and have more time to spend in parks.

Ecological models posit interactions among multiple levels of influence (e.g., individual, interpersonal, environmental) on behavior (McLeroy et al., 1988; Sallis et al., 2008; Stokols, 1996). An implication of these models is that programmatic interventions to enhance psychosocial constructs associated with physical activity may be more effective among people located in physical settings that enable rather than restrict physical activity. Conversely, improving the built environment to promote physical activity may be more effective where efforts are made to enhance psychosocial support and motivation.

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Although studies have investigated multivariable models that include both environmental and psychosocial predictors of physical activity (e.g., Giles-Corti and Donovan, 2002, 2003), only two studies have investigated interactions between environmental and psychosocial variables. One study investigating environment by psychosocial interactions found that access to recreation facilities was positively related to physical activity in participants with high levels of intention but negatively related to physical activity in participants with low levels of intention (Rhodes et al., 2006). Another study found that access to recreation facilities was positively associated with physical activity only in participants with low psychosocial attributes (i.e., self-efficacy and enjoyment) (Cerin et al., 2008). These inconsistent findings warrant further investigation.

Though general predictions about the relevance of correlates for various domains of physical activity can be derived from activity-specific ecological models (Saelens et al., 2003b; Sallis et al., 2006), there is no basis for predicting specific environment by psychosocial interactions. The present study explored interactions among individual, interpersonal, and environmental correlates of physical activity in a large sample of community-dwelling older adults. The psychosocial and environmental variables were chosen based on their conceptual relevance and empirical associations with different domains of physical activity in previous studies (Saelens et al., 2003a; Trost et al., 2002; van Cauwenberg et al., 2010). Walkability was expected to interact with the psychosocial variables in explaining walking for transportation, whereas access to parks and recreation facilities, neighborhood aesthetics, and walking infrastructure were expected to interact with the psychosocial variables in explaining walking for leisure. All of the environmental variables were expected to interact with the psychosocial variables in explaining total physical activity. In agreement with predictions from ecological models, it was hypothesized that individual/interpersonal and environmental factors would be synergistic in their relation with physical activity, such that physical activity minutes would be greatest when both factors were supportive of physical activity, lowest when neither factor was supportive, and in between when only one factor was supportive.

Methods

Design

The present analyses used data from the Senior Neighborhood Quality of Life Study (SNQLS) that was conducted in the Baltimore, Maryland-Washington, DC and Seattle-King County, Washington regions during 2005–2008 (King et al., 2011). The primary aim of SNQLS was to investigate the relationship between built environment factors and physical activity in older adults. Census block groups (n = 216) were chosen to represent high and low walkability based on an index using parcel and street network data from which measures of residential density, land use mix, street connectivity, and retail floor area ratio were derived, as well as high and low income level based on census data (King et al., 2011; Buman et al., 2010).

Participants

A total of 718 seniors who lived independently in the community were recruited. Households within each selected block group with an adult over age 65 years were identified by a marketing company. The sampling was designed to be balanced by gender and to approximate the ethnic distribution of the regions. Participants were ineligible if they were unable to walk or complete surveys in English. Participants were mailed an accelerometer and survey with instructions to complete the survey after wearing the accelerometer for one week. Participants returned the accelerometer and survey in the mail and received an incentive.

Measures

Demographics

Age, gender, ethnicity (non-Hispanic white vs. non-white), education (college degree vs. no college degree), number of adults and children in the household, length of time at current address, number of motor vehicles per adults in household, and marital status (married/living together vs. other) were collected by survey.

Psychosocial measures

Self-efficacy for physical activity was assessed using a 3-item (α = 0.87) scale asking participants to rate their confidence in their ability to walk ½ block, 4 blocks, and 10 blocks on a 10-point scale. Psychosocial barriers to physical activity were assessed using a 4-item (α = 0.53) scale asking participants to rate barriers such as discomfort and time constraints (Marcus et al., 1992). Social support for physical activity was measured by asking participants to separately rate how often during the past 3 months their friends and family did supportive behaviors such as walk or exercise with them and gave them encouragement to do physical activity (4 items; α = 0.67) (Sallis et al., 1987). In a previous study, two-week ICCs for the barriers and social support scales were .61 and .67 and correlations with self-report physical activity were −.19 and .12 in women (Carlson et al., in press).

Objective environment measures

Data from the county-level tax assessor, land use at the parcel level, and street networks were integrated into GIS to create a walkability index for each participant based on a 500 meter buffer around his/her home. The index consisted of the sum of z-scores of measures of residential density, retail floor area ratio, intersection density and land use mix (Frank et al., 2010b). Parcel-level land use data, supplemented with lists from local parks agencies, were used to determine the number of parks within the 500 meter buffer around each participant's home. Private recreation facilities (e.g., gyms, dance and martial arts studios) within each county were identified and geocoded (Abercrombie et al., 2008). The count of parks and private recreation facilities within 500 m of each participant's home was calculated and dichotomized as 0 or ≥1.

Perceived environment measures

Neighborhood aesthetics was assessed using the following items: "There are trees along the streets in my neighborhood", "There are many interesting things to look at while walking in my neighborhood", "There are many attractive natural sights in my neighborhood (such as landscaping, views)" and "There are attractive buildings/homes in my neighborhood" from the Neighborhood Environment Walkability Scale (NEWS; α = 0.77). Presence of walking/cycling facilities was measured using the items "There are sidewalks on most of the streets in my neighborhood", "Sidewalks are separated from the road/traffic in my neighborhood by parked cars" and "There is a grass/dirt strip that separates the streets from the sidewalks in my neighborhood" from the NEWS (α = 0.74) (Saelens et al., 2003b).

Physical activity

ActiGraph accelerometers (Manufacturing Technology Incorporated, models 7164 and 71256; Fort Walton, FL) with a 60-second epoch setting were used to objectively measure participants' total physical activity (Buman et al., 2010). For scoring, 5 valid days were required. A valid day contained at least 8 valid hours of wear time, and a valid hour contained no more than 45 consecutive zero counts. Average minutes per week (min/week) of moderate to vigorous physical activity (MVPA) were calculated using previously established cut-points (1953–10000 counts) (Freedson et al., 1998).

The Community Healthy Activities Model Program for Seniors (CHAMPS) survey was used to assess self-reported physical activity. Six-month stability was acceptable (ICCs 0.58–0.67), and the measure was able to discriminate between inactive, somewhat active, and active persons (Stewart et al., 2001). An average min/week variable was computed for the walking for transportation and walking for leisure single item scales.

Analysis

Mixed effects regression models were conducted using SPSS version 17.0 with block group entered as a random effect cluster variable. The intraclass correlation coefficient (ICC) assessing proportion of variance between block groups was examined for each outcome variable with no other variables in the model. One model was estimated for each outcome variable that included the psychosocial variables, environmental variables, and their interactions (3 models total). Continuous independent variables were standardized to have a mean of zero and standard deviation (SD) of 1, so the unstandardized coefficients (B) with 95% confidence intervals (CI) could be interpreted as change in min/week of physical activity for every 1 SD change in the predictor.