

# Home and Workplace Built Environment Supports for Physical Activity

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**Background:** Physical inactivity has been associated with obesity and related chronic diseases. Understanding built environment (BE) influences on specific domains of physical activity (PA) around homes and workplaces is important for public health interventions to increase population PA.

**Purpose:** To examine the association of home and workplace BE features with PA occurring across specific life domains (work, leisure, and travel).

**Methods:** Between 2012 and 2013, telephone interviews were conducted with participants in four Missouri metropolitan areas. Questions included sociodemographic characteristics, home and workplace supports for PA, and dietary behaviors. Data analysis was conducted in 2013; logistic regression was used to examine associations between BE features and domain-specific PA.

**Results:** In home neighborhoods, seven of 12 BE features (availability of fruits and vegetables, presence of shops and stores, bike facilities, recreation facilities, crime rate, seeing others active, and interesting things) were associated with leisure PA. The global average score of home neighborhood BE features was associated with greater odds of travel PA (AOR=1.99, 95% CI=1.46, 2.72); leisure PA (AOR=1.84, 95% CI=1.44, 2.34); and total PA (AOR=1.41, 95% CI=1.04, 1.92). Associations between workplace neighborhoods' BE features and workplace PA were small but in the expected direction.

**Conclusions:** This study offers empirical evidence on BE supports for domain-specific PA. Findings suggest that diverse, attractive, and walkable neighborhoods around workplaces support walking, bicycling, and use of public transit. Public health practitioners, researchers, and worksite leaders could benefit by utilizing worksite domains and measures from this study for future BE assessments.

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## Introduction

Physical inactivity is a primary modifiable risk factor for obesity and related chronic diseases.<sup>1</sup> Evidence shows a steep rise in rates of physical inactivity among urban populations.<sup>2</sup> Fewer than 50% of adults and 40% of youth meet U.S. physical activity (PA) guidelines, with the built environment (BE) identified as a reason for limited PA.<sup>3–6</sup>

Elements of home neighborhood BE (e.g., streets, sidewalks) have been widely investigated.<sup>7</sup> However, their impact on specific domains of everyday life in which PA occurs (e.g., at work, while travelling) needs exploration. Because adults spend about half of their waking hours at workplaces,<sup>8</sup> the influence of workplace neighborhoods is potentially important. This study examines relationships between home and workplace BE features; domain-specific PA (work, travel, leisure); and total PA.

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## Methods

In 2012–2013, telephone interviews (N=2,015) were conducted with employed adults residing in four Missouri metropolitan areas: St. Louis, Kansas City, Springfield, and Columbia. Eligibility criteria included (1) ability to speak English or Spanish; (2) age 21–65 years; (3) employed in at least one occupation (20 hours/week)

at a single worksite; and (4) worksite has  $\geq$  five employees. Exclusion criteria included (1) presence of medical condition that interferes with ability to walk; (2) pregnancy; and (3) self-employment. Given lack of consensus on what defines a unique neighborhood,<sup>9</sup> census tracts were used as the primary definition. Two samples were drawn: a (1) representative sample, with oversampling of census tracts in small metropolitan areas; and (2) high-density/minority sample drawn from census tracts with high population density and high minority population (African American and Hispanic). Detailed study design, participant recruitment, and sociodemographic characteristics (Appendix Table 1) have been described in supplementary text and related studies.<sup>10,11</sup>

Twelve items from the Physical Activity Neighborhood Environment Survey (PANES)<sup>12</sup> (Table 1) were used to measure BE features around homes and workplaces. Items were identical across both neighborhoods. Reliability of items has been previously established, with reliability coefficients above 0.60.<sup>10</sup> Four-point Likert-type scale response options ranging from 1 (*strongly agree*) to 4 (*strongly disagree*) were combined as “agree” (*strongly agree, agree*) and “disagree” (*disagree, strongly disagree*). A global average score for home and workplace neighborhood BE features was constructed using Likert-type scale responses from all 12 items.

In 2013, a series of multiple logistic regressions were used to identify BE predictors of meeting CDC-recommended levels ( $\geq$ 150 minutes/week) for work, travel, leisure, and total PA (dichotomous outcomes) using SPSS, version 21. Pairwise interactions between PANES items and interactions between home and workplace global average scores were tested. Physical activity was measured with the International Physical Activity Questionnaire (IPAQ).<sup>13</sup> Models were adjusted for age, sex, race, education, and income. Descriptive statistics (Appendix Tables 2–4) and details

on data analysis are provided in the supplementary text. The IRBs of Washington University in St. Louis and University of Missouri-Columbia approved study procedures.

## Results

In home neighborhoods, seven of 12 BE features (availability of fruits and vegetables, presence of shops and stores, bike facilities, recreation facilities, crime rate, seeing others active, and interesting things to look at) were associated with leisure PA (Table 1). Six home neighborhood BE features significantly predicted travel PA. Except for crime, no clear associations of individual home neighborhood BE features with workplace PA or total PA were observed. The global average score of home neighborhood BE features predicted significant increases in adjusted odds of engagement in travel PA (AOR=1.99, 95% CI=1.46, 2.72); leisure PA (AOR=1.84, 95% CI=1.44, 2.34); and total PA (AOR=1.41, 95% CI=1.04, 1.92).

A smaller number of associations between workplace neighborhood BE features and workplace PA were significant. Three of 12 workplace neighborhood BE features (bike facilities, interesting things to look at, and crime rate) significantly predicted workplace PA (Table 2). Although other workplace BE features were not significant, overall adjusted odds of engagement in workplace PA were in the expected direction. Certain BE

**Table 1.** Home neighborhood predictors of meeting CDC-recommended levels of work, travel, leisure, and total physical activity, AOR<sup>a</sup> (95% CI)

Variable	Work PA	Travel PA	Leisure PA	Total PA
Large selection of fresh fruits and vegetables	1.06 (0.84, 1.35)	1.27 (0.94, 1.72)	<b>1.33 (1.05, 1.68)</b>	1.23 (0.92, 1.63)
Opportunities to purchase fast food	0.77 (0.58, 1.02)	1.20 (0.85, 1.70)	0.92 (0.70, 1.21)	0.77 (0.55, 1.09)
Presence of healthy restaurants	0.99 (0.80, 1.22)	1.28 (0.98, 1.68)	1.12 (0.91, 1.39)	1.10 (0.84, 1.43)
10, –15 minute walk to a transit stop	0.89 (0.70, 1.13)	1.06 (0.78, 1.45)	1.01 (0.80, 1.28)	0.90 (0.66, 1.22)
Sidewalks on most streets	0.94 (0.72, 1.23)	<b>1.61 (1.11, 2.34)</b>	1.23 (0.95, 1.59)	1.01 (0.73, 1.40)
Shops, stores, or markets	1.08 (0.89, 1.32)	<b>1.33 (1.03, 1.71)</b>	<b>1.22 (1.01, 1.48)</b>	1.16 (0.91, 1.49)
Facilities to bicycle	0.90 (0.71, 1.09)	<b>1.31 (1.02, 1.67)</b>	<b>1.27 (1.05, 1.53)</b>	1.09 (0.86, 1.39)
Recreation facilities	1.06 (0.84, 1.34)	<b>1.46 (1.08, 1.97)</b>	<b>1.27 (1.02, 1.59)</b>	1.27 (0.96, 1.67)
Crime rate makes it unsafe to walk	<b>0.80 (0.64, 0.98)</b>	0.99 (0.76, 1.27)	<b>1.25 (1.02, 1.54)</b>	1.05 (0.81, 1.36)
Traffic makes it difficult to walk	0.80 (0.63, 1.03)	0.94 (0.70, 1.25)	1.23 (0.97, 1.56)	1.04 (0.73, 1.41)
See people being physically active	1.03 (0.82, 1.30)	<b>1.51 (1.13, 2.03)</b>	<b>1.59 (1.27, 2.00)</b>	1.24 (0.94, 1.64)
Interesting things to look at	0.95 (0.77, 1.17)	<b>1.31 (1.01, 1.70)</b>	<b>1.68 (1.37, 2.07)</b>	1.18 (0.92, 1.53)
Global Average Home Neighborhood Score	0.91 (0.71, 1.16)	<b>1.99 (1.46, 2.72)</b>	<b>1.84 (1.44, 2.34)</b>	<b>1.41 (1.04, 1.92)</b>

Note: Boldface indicates significance ( $p < 0.05$ ). *n* range: 1,784–1,862.

<sup>a</sup>Adjusted for age (continuous), and sex, race, education, income (all categorical).

PA, physical activity.

**Table 2.** Workplace neighborhood predictors of meeting CDC recommended levels of work, travel, leisure, and total physical activity, AOR<sup>a</sup> (95% CI)

Variable	Work PA	Travel PA	Leisure PA	Total PA
Large selection of fresh fruits and vegetables	1.16 (0.95, 1.43)	1.22 (0.95, 1.57)	<b>1.23 (1.01, 1.50)</b>	1.08 (0.84, 1.39)
Opportunities to purchase fast food	0.87 (0.69, 1.10)	0.85 (0.63, 1.15)	1.01 (0.81, 1.27)	1.17 (0.86, 1.58)
Presence of healthy restaurants	0.98 (0.79, 1.22)	<b>1.53 (1.16, 2.02)</b>	<b>1.26 (1.02, 1.55)</b>	1.05 (0.83, 1.38)
10, 15 minute walk to a transit stop	1.21 (0.94, 1.56)	1.34 (0.96, 1.87)	1.27 (0.99, 1.62)	<b>1.36 (1.01, 1.84)</b>
Sidewalks on most streets	1.10 (0.88, 1.38)	1.30 (0.97, 1.74)	1.21 (0.97, 1.51)	<b>1.38 (1.05, 1.81)</b>
Shops, stores, or markets	1.05 (0.86, 1.27)	<b>1.51 (1.19, 1.93)</b>	1.14 (0.94, 1.38)	1.16 (0.92, 1.48)
Facilities to bicycle	<b>1.29 (1.06, 1.57)</b>	<b>1.63 (1.28, 2.07)</b>	<b>1.33 (1.10, 1.61)</b>	<b>1.54 (1.20, 1.98)</b>
Recreation facilities	1.15 (0.94, 1.40)	<b>1.60* (1.25, 2.05)</b>	<b>1.25 (1.03, 1.51)</b>	1.20 (0.94, 1.53)
Crime rate makes it unsafe to walk	<b>0.76 (0.60, 0.96)</b>	1.06 (0.80, 1.40)	1.19 (0.96, 1.49)	0.92 (0.69, 1.22)
Traffic makes it difficult to walk	0.90 (0.74, 1.10)	1.15 (0.91, 1.47)	1.16 (0.96, 1.41)	1.02 (0.80, 1.31)
See people being physically active	1.14 (0.94, 1.40)	<b>1.44 (1.21, 1.86)</b>	<b>1.22 (1.01, 1.49)</b>	1.18 (0.92, 1.51)
Interesting things to look at	<b>1.22 (1.00, 1.59)</b>	<b>1.90 (1.47, 2.45)</b>	<b>1.21 (1.00, 1.46)</b>	<b>1.33 (1.05, 1.70)</b>
Global Average Workplace Neighborhood Score	1.01 (0.82, 1.25)	<b>2.13 (1.62, 2.80)</b>	<b>1.34 (1.09, 1.64)</b>	<b>1.30 (1.00, 1.68)</b>

Note: Boldface indicates significance ( $p < 0.05$ ).  $n$  range: 1,708–1,864.

<sup>a</sup>Adjusted for age (continuous), and sex, race, education, income (all categorical).

PA, physical activity.

features in workplace neighborhoods (e.g., healthy restaurants, bicycle and recreation facilities) significantly supported travel and leisure PA. Bike facilities and presence of interesting things in workplace neighborhoods were significantly associated with PA across all domains. Sidewalks and walkable access to transit were significantly associated with total PA around workplaces.

Similar to home neighborhoods, global average score of workplace BE features was associated with travel PA (AOR=2.13, 95% CI=1.62, 2.80); leisure PA (AOR=1.34, 95% CI=1.09, 1.64); and total PA (AOR=1.30, 95% CI=1.00, 1.68). However, the association between global average score of workplace neighborhood supports with workplace PA was insignificant (AOR=1.01, 95% CI=0.82, 1.25). No significant interactions (pairwise, global average scores) were found between home and workplace BE features.

## Discussion

This study is among the first to examine associations between home and workplace BE features (individual, global average) and PA domains around homes and workplaces. Previous studies have demonstrated significant associations between individual BE features and total PA,<sup>14–16</sup> predominantly in home neighborhoods.

The presence of physically active people and interesting things around homes improved odds of leisure and

travel PA. Three BE features around workplaces (presence of shops and stores, bicycle facilities, and recreation facilities) were associated with travel PA, implying higher engagement in active travel. Bicycling facilities around workplaces increased odds of engagement in travel PA. Interesting things around workplaces resulted in a greater likelihood of engagement in PA across all domains. Around workplaces, public transit access and presence of sidewalks were significantly associated with total PA, whereas healthy restaurants promoted leisure and travel PA. These associations imply that diverse, attractive, and walkable workplace neighborhoods can serve as incentives for walking, bicycling, and active commuting. Cumulatively, BE features predicted increased odds of travel, leisure, and total PA around homes and workplaces, providing additional evidence of BE supports for specific PA domains.

Crime is a frequently cited barrier to PA.<sup>17</sup> However, its association with PA was inconsistent in this analysis. Previous studies have yielded similar inconclusive results acknowledging that the impact of perceived safety from crime on walking in residential neighborhoods needs careful examination.<sup>14,17</sup> This may relate to the complexity of measuring crime (e.g., time of occurrence, people's perceptions, and coping mechanisms influence PA differently).<sup>14</sup>

The cross-sectional study design limits causal inference.<sup>18</sup> Certain census tracts were oversampled to increase variability by race/ethnicity and walkability, but this was

not adjusted for in statistical models. Self-reported PA and neighborhood measures are subject to bias (e.g., social desirability of PA; physically active people may notice more neighborhood destinations). Another limitation of this study and PA literature in general is a lack of consensus on measuring workplace PA (e.g., lack of tested items, inadequate details on types of workplace PA).<sup>19,20</sup> The IPAQ measure of workplace PA is meant to capture only work-related PA.<sup>21,22</sup> However, without a clear description of workplace PA, study participants could be reporting time spent in PA during work hours (e.g., walking or bicycling to a restaurant during lunch) as workplace, leisure, or travel PA.

Data on BE characteristics to support PA across specific domains (work, travel, and leisure) provide information to guide design decisions for healthy living around homes and workplaces.<sup>23,24</sup> Addition of key worksite domains can guide the development of objective measures of worksite PA to explore combined effects of BE around homes and workplaces. Additional research is needed to advance measurement and evaluation of workplace PA.

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## Appendix

### Supplementary data

Supplementary data associated with this article can be found at <http://dx.doi.org/10.1016/j.amepre.2014.08.023>.