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GIS-measured Walkability, Transit, and Recreation Environments in Relation to Older Adults' Physical Activity: A Latent Profile Analysis

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Abstract

An infrequently studied question is how diverse combinations of built environment (BE) features relate to physical activity (PA) for older adults. We derived patterns of Geographical Information Systems- (GIS) measured BE features and explored how they accounted for differences in objective and self-reported PA, sedentary time, and BMI in a sample of older adults. Senior Neighborhood Quality of Life Study participants (N=714, aged 66–97 years, 52.1% women, 29.7% racial/ethnic minority) were sampled in 2005–2008 from the Seattle-King County, WA and Baltimore, MD-Washington, DC regions. Participants' home addresses were geocoded, and net residential density, land use mix, retail floor area ratio, intersection density, public transit density, and public park and private recreation facility density measures for 1-km network buffers were derived. Latent profile analyses (LPAs) were estimated from these GIS-based measures. In multilevel regression models, profiles were compared on accelerometer-measured moderate-to-vigorous PA (MVPA) and sedentary time and self-reported PA, adjusting for covariates and clustering. Analyses were conducted in 2014–2015. LPAs yielded three profiles: low walkability/

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transit/recreation (L-L-L); mean walkability/transit/recreation (M-M-M); and high walkability/transit/recreation (H-H-H). Three PA outcomes were more favorable in the HHH than the LLL profile group (difference of 7.2 minutes/day for MVPA, 97.8 minutes/week for walking for errands, and 79.2 minutes/week for walking for exercise; all $ps < 0.02$). The most and least activity-supportive BE profiles showed greater differences in older adults' PA than did groupings based solely on a 4-component walkability index, suggesting that diverse BE features are important for healthy aging.

Keywords

built environment; environment design; aging in place; obesity; active transportation; exercise

INTRODUCTION

Adults over 65 years of age represent a large (14%) and rapidly increasing proportion of the US population, growing by almost 25% since 2003¹. As for younger and middle-aged adults, regular physical activity (PA) and moderate-to-vigorous PA (MVPA) are important for improving cardiovascular fitness and as predictors of physiological risk factors (e.g., cardiovascular functioning, bone density, body mass index [BMI])²⁻⁴, morbidity (e.g.,⁵⁻⁹), and mortality (e.g.,¹⁰⁻¹²) in older adults. Aerobic PA guidelines for healthy older adults recommend 150-minutes per week of moderate or 75 minutes of vigorous PA, or an equivalent combination to prevent morbidities and reduce mortality related to cardiovascular disease, stroke, and metabolic dysregulation.^{13,14} Despite these long-standing recommendations, national studies have estimated that few (< 9%) adults aged 60 and older meet them.^{15,16}

Increasingly, research has linked built environment (BE) features to PA among adults in general (e.g.,¹⁷⁻²¹), and older adults specifically (e.g.,²²⁻²⁶). Indicators of greater neighborhood walkability (e.g., proximity to destinations, walkability index) have been linked to higher levels of overall PA and active transportation in older adults.²⁵⁻²⁷ Other BE features, such as access to public transit access and recreation facilities may also contribute positively to the likelihood of engaging in active transportation and other PA among all adults (e.g.,^{22,28-32}) including older adults (e.g.,^{27,33,34}), suggesting these features may also be important aspects of the activity-supportiveness of neighborhoods.

Typically, examinations of associations between BE features and PA in older adults have focused either on only one feature or quantitative indicator (e.g., parks³⁵ or pedestrian connectivity²⁷) or the unique contribution of each feature after adjusting for the presence or level of other features (e.g.,^{33,36}). These approaches, respectively, can yield relatively straightforward models that may fail to capture BE complexity or complex multivariable models that do not necessarily illustrate which patterns of features are relatively more supportive of PA. Clustering methods can reduce model complexity while using information from several BE indicators, but some methods present limitations. Conventional principal components analysis identifies groups of similar (correlated) indicators, rather than groups of similar observations. Traditional cluster analysis methods identify groups of similar

observations, but place constraints on indicator scaling and don't afford straightforward statistical comparisons among models. Supervised machine learning methods (e.g., support vector machines) can find groups of similar observations and allow for statistical comparisons, but they depend on the use of "training" sets of observations that have a priori known class memberships. Latent profile analysis (LPA) addresses these limitations by yielding a discrete set of model-derived clusters of observations with distinctive patterns (profiles) of indicator (BE feature) scores in each model and allows for statistical comparison of models of differing complexity. Feature patterns derived from LPA models using perceived (vs. GIS-measured) BE features have shown predictive utility for MVPA and transportation-related physical activity for younger and older adults^{22,37} and children³⁸, and with GIS-measured features for adults aged 20–65.³⁹ Identifying feature patterns from objective measures conceptually associated with regular PA in adults over age 65 may help inform neighborhood designs that allow older adults remain relatively active and healthy.

The first major goal of the current study was to derive empirically defined latent profiles of seven GIS-measured BE features using pooled data from a sample of older adults residing in two U.S. metropolitan regions. The second major goal was to examine how neighborhood profiles were related to objectively measured MVPA (measuring total PA volume and intensity) and self-reported PA (measuring specific types of PA engaged in, e.g., walking for errands), objectively measured sedentary time, and BMI, which is related to both MVPA and overall health in older adults. We hypothesized that participants residing in neighborhoods characterized by an overall PA-supportive profile, compared to other profiles, would show higher PA, and lower sedentary time and BMI.

METHODS

This analysis used data from the Senior Neighborhood Quality of Life Study (SNQLS), an observational study examining relations between block group-level walkability and multiple health-related outcomes, including PA and BMI in adults over 65 years old. Detailed descriptions of the SNQLS study can be found elsewhere (e.g., ²⁷). Briefly, Census block groups in metropolitan Seattle-King County, WA and Baltimore, MD-Washington DC regions were screened for the study based on the BE construct of walkability, with walkability defined by block-group-level net residential density, land use mix, street connectivity and retail floor area ratio⁴⁰. Block groups were ranked based on potentially available participants, and then categorized based on region-specific median splits for walkability and Census-based median household income, which were then crossed yielding a 2 (lower walkability vs. higher walkability) x 2 (lower income vs. higher income) matrix of sampling strata or quadrants. A minimum of 13 block groups within each sampling quadrant were identified and participants were subsequently selected from these block groups. Participants ($n = 714$, 66–97 years old, 53.1% female, 29.3% ethnic minority), from whom informed consent was obtained, were systematically sampled and recruited across all 4 quadrants simultaneously over 12 months to prevent seasonal bias. At each of two time points six months apart, participants wore accelerometers over a 7-day period and completed questionnaires measuring socio-demographics and self-reported PA; data from the first time point were used here.

Neighborhood Environment Measures

For the current analysis, BE features were measured for the geographic area around each participant's home, as residence-based measures may be more important than those for the BE of a person's home block group.⁴⁰ Using geographic information systems (GIS) methods and software (ArcGIS 10.0; ESRI; Redlands, CA), the location of each participant's residence was geocoded and a 1-km street-network buffer was computed around that location. Next, as described below, seven different BE features were quantified for each participant's residence using this buffer.

Walkability Components—Neighborhood walkability comprises components representing pedestrian accessibility of destinations near the home.⁴⁰ The components are as follows: (1) *net residential density*—the ratio of residential dwelling units to land area devoted to residential land use within a buffer; (2) *intersection density*—the number of intersections with three or more legs divided by the total land area of the buffer—higher intersection density corresponds to shorter, more direct paths between destinations; (3) *land use mix* or the diversity and evenness of nearby and accessible destinations present in a buffer across five land use types (residential, retail/commercial, entertainment, food-related, and civic/institutional)—with normalized values ranging from 0 (indicating a single land use, most likely residential) to 1 (indicating an even distribution, i.e., 20% of parcel areas dedicated to each of 5 use types); and (4) *retail floor area ratio* (RFAR)—the ratio of retail building floor areas divided by retail parcel land areas—low RFAR indicates retail development likely to have substantial space devoted to parking, while high RFAR indicates smaller building setbacks typical of pedestrian-oriented designs. Individual walkability components were included in the latent profile analyses rather than a single walkability index score computed from the four components.

Public Transportation—Spatial datasets of transit stops and stations were obtained from regional repositories. Because the majority of participants did not have access to rail stops/stations, buffer-level bus and rail counts were combined to yield a single variable for total public transit density within each participant's buffer defined as the number of stops/stations divided by the area of the buffer.

Recreation Environment—Using information collected from park departments, parcel data, and the Yellow Pages, SNQLS investigators enumerated recreation facilities after conducting a comprehensive assessment of parks, fitness centers, community recreation centers, swimming pools, yoga, and ballroom dance studios, among others, in each region. Parks were defined as freely accessible, improved and unimproved green spaces designated as parks by the above data sources. Private recreation facilities included places where physical activity could occur and required payment (e.g., golf courses, fitness facilities). Separate *park density* and *recreation facility density* variables were operationalized, respectively, as the number of park locations and number of private recreation locations divided by the area of the participant's buffer.

Physical Activity, Sedentary, and Demographic Measures

Objectively-measured PA—Participants wore ActiGraph accelerometers (Pensacola, FL; models 7164 or 71256) on their right hip using an elastic belt during waking hours for 7 days to measure MVPA. Participants were asked to re-wear the accelerometer if < 5 valid days or < 66 valid hours across 7 days were obtained. Accelerometer data were scored using MeterPlus version 4.0 software (Santech, Inc.). For scoring MVPA, a ‘valid day’ was defined as ≥ 10 valid hours of wear, and a valid hour was < 30 consecutive zero values. The difference in the number of consecutive zeros used to define a valid hour affects the estimates of non-wear time and sedentary time most. A lower threshold used to define valid hour (i.e., fewer consecutive zeros) results in more non-wear time and less sedentary time daily. On valid days, we summed each minute < 100 counts/minute (cpm) to compute total sedentary minutes and the duration of moderate-to-vigorous intensity minutes was based on the Freedson cut-point for adults (≥ 1552 cpm).⁴¹ We also examined “low light” intensity PA (100–1040 cpm) and “high light” intensity PA (1041–1951 cpm).⁴² The average minutes of moderate-to-vigorous activity, low light, high light, and sedentary time per valid wearing day were examined independently in analyses. We also examined whether participants attained greater than 30 minutes per day on average, which approximates the 150 minutes per week guideline. ActiGraph accelerometers have produced reliable and valid estimates of sedentary time and PA in adults when compared to indirect calorimetry.⁴³

Self-reported PA—Participants completed the Community Healthy Activities Model Program for Seniors (CHAMPS) physical activity questionnaire for older adults⁴⁴, which assessed their usual amounts of various physical activities over the past 4 weeks. The CHAMPS asks participants to report the number of times per week they usually engage in a particular activity and the duration spent in each activity. Duration items have 6 response options ranging from less than 1 hr/week to 9 or more hr/week. The midpoint of each response option (e.g., 1–2.5 hr/week = 105 min) was used as the estimate of time spent in the activity. Time spent walking for errands was measured using a single item from the CHAMPS (walk to do errands), and walking for exercise was measured using the sum of three CHAMPS items (walk your dog, walk fast or briskly for exercise, walk uphill or hike uphill). The CHAMPS has shown good reliability (6-month stabilities [ICCs] = 0.58–0.67) and validity.⁴⁰

Demographics—Participants reported demographic and personal characteristics including sex, age (years), race/ethnicity (non-Hispanic white versus non-white and/or Hispanic), annual household income (eleven levels from <\$10,000 to >\$100,000 USD), educational attainment (seven levels from 7th grade to completed graduate degree), number of motor vehicles divided by eligible drivers in household (continuous), marital or cohabitation status (married or living together versus other), number of people in household (continuous), and years at current address (continuous).

Analytic Approach

First we conducted a latent profile analysis (LPA) with seven BE feature indicators using Mplus 7.22.⁴⁵ LPA derives mutually exclusive profiles of observations (i.e., patterns) that maximize between-profile variance and minimize within-profile variance across the set of

continuous indicators. Adjustment for non-independence was made via the Mplus TYPE=COMPLEX specification, with block groups specified as clusters (i.e., higher-level sampling units). LPA models were estimated using a dataset ($n = 714$) based on participants from both regions (Seattle/King County: $n = 364$; Baltimore/Washington, DC: $n = 350$). We derived solutions (models) ranging from 1 to 4 profiles. Selection of the final solution was based on consideration of model fit indices, subjective interpretability of the derived profiles, and within-profile sample sizes. Relative model fit and quality was judged using sample size-adjusted Bayesian Information Criterion (BIC) and model log likelihood values. Upon selection of the appropriate LPA solution, each respondent was assigned to the profile for which his/her analytically derived probability of membership was highest.

Next, we used generalized linear mixed models in SAS 9.4 to examine relations between final BE profiles (i.e., profile membership) and log-transformed accelerometer-measured MVPA, low light and high light PA, and sedentary time, self-reported walking for errands and walking for exercise, BMI (in PROC MIXED), and a dichotomous indicator of having met MVPA recommendations (< 150 min/week MVPA vs. ≥ 150 min/week MVPA; in PROC GLIMMIX). Respondents were treated as being nested within block groups, and block group-level intercepts were modeled as random effects. All regression models adjusted for sex, age, annual household income, education, race/ethnicity, motor vehicles divided by adults in household, marital status, number of people in household, and years at current address. In models using accelerometer-measured outcomes, we also adjusted for total hours of accelerometer wear time on all valid wear days. We present anti-logged model-adjusted means and standard error bars from analyses of log-transformed measures.

RESULTS

Table 1 presents descriptive statistics on participant demographic and personal characteristics, physical activity and sedentary times, and neighborhood environment factors

Latent Profile Analyses

Model fit indices (i.e., BIC, log likelihood) indicated that a 4-profile solution (BIC = 20990.431, log likelihood = -10430.699) was better than a 3-profile solution (BIC = 21449.86, log likelihood = -10673.993); however, the 4-profile solution could not be clearly interpreted, so the 3-profile solution was selected. Figure 1 shows the patterns of standardized LPA-estimated profile-specific indicator means (Z-scores standardized with respect to the observed sample means and standard deviations) for the 3-profile solution.

In the 3-profile solution, the most common profile was labeled “low walkable, low transit access, low recreation access” (L-L-L) and comprised 63.4% ($n = 453$) of the participants. This profile was characterized by a combination of low values for residential density, land use mix, intersection density, with relatively low values on public transit access, and limited access to parks and private recreational facilities. The next most common profile was labeled “moderately-high walkability, moderately-high transit access, and moderately-high recreation access” (MH-MH-MH) and comprised 29.7% ($n = 212$) of participants. This profile was characterized by above average values (i.e., Z-scores of approximately 0.5) for all environmental indicators. The third most common profile was labeled “high walkable,

high transit access, high recreation access” (H-H-H) and comprised 6.9% ($n = 49$) of participants. H-H-H was characterized by high Z-score values for residential density, land use mix, retail FAR, recreation density, and transit density.

Between-profile Differences in PA, Sedentary Time, and BMI

Accelerometer-measured PA and Sedentary Time—Figure 2 presents model-adjusted geometric means and standard errors for accelerometer-measured MVPA and arithmetic means and standard errors for sedentary behavior across latent profiles, along with results of pairwise between-profile comparisons of means from the linear mixed model analyses. Tests of overall between-profile differences were significant for MVPA minutes per day ($p = .008$). Participants in the L-L-L profile had an adjusted geometric mean of 6.9 MVPA min/day (adjusted raw score $M = 11.6$ min/day) which significantly differed from 8.9 MVPA min/day (adjusted raw $M = 15.0$ min/day) in the M-M-M profile and 11.6 min/day (adjusted raw $M = 18.8$ min/day) in H-H-H profile, $p = .013$ and $p = .006$, respectively. Participants in the M-M-M and H-H-H profiles did not differ significantly from each other ($p = .167$). Sedentary time differed significantly between the L-L-L and H-H-H profiles (adjusted raw $M = 564.3$ min/day vs. 529.4 min/day, $p = .027$); however, sedentary time for the M-M-M profile (adjusted raw $M = 558.8$ min/day) did not differ significantly from that for either the L-L-L profile ($p = .511$) or the H-H-H profile ($p = .072$). No significant between-profile differences were found for proportion of participants meeting MVPA recommendations (≥ 150 MVPA min/week). We also explored between-profile differences in “low light” intensity PA and “high light” intensity PA. None of these differences were statistically significant.

Self-reported PA—Figure 3 shows between-profile differences in hours per week of walking for errands and walking for exercise. All between-profile comparisons of logged values of walking for errands were statistically significant, with walking in the L-L-L group profile (adjusted geometric $M = 1.18$ hr/week; adjusted raw $M = 0.34$ hr/week) being significantly lower than in the M-M-M (adjusted geometric $M = 1.61$ hr/week; adjusted raw $M = 0.92$ hr/week) and the H-H-H (adjusted geometric $M = 2.45$ hr/week; adjusted raw $M = 1.97$ hr/week) profiles, and significantly lower in the M-M-M profile than in the H-H-H profile (all $ps < .001$). The ordering of profile means for walking for exercise was the same as that for walking for errands, but the pattern of significant differences was not. Only the difference between the L-L-L profile (adjusted geometric $M = 2.85$ hr/week; adjusted raw $M = 3.27$ hr/week) and the H-H-H profile (adjusted geometric $M = 4.07$ hr/week; adjusted raw $M = 4.59$ hr/week) was statistically significant ($p = .017$) for walking for exercise. The M-M-M profile (adjusted geometric $M = 3.06$ hr/week; adjusted raw $M = 3.17$ hr/week) did not differ significantly from either the L-L-L profile ($p = .358$) or the H-H-H profile ($p = .064$).

BMI—Although profile means for BMI were ordered as expected (i.e., lowest in the H-H-H profile, highest in the L-L-L profile), they not differ significantly across profiles. The difference between the L-L-L profile ($M = 26.9$ kg/m²) and the H-H-H profile ($M = 25.3$ kg/m²) approached statistical significance ($p = .058$), but the L-L-L vs. M-M-M ($M = 26.5$ kg/m²) and M-M-M vs. H-H-H differences did not ($p = .428$ and $p = .158$, respectively).

DISCUSSION

The current analysis builds on previous work from SNQLS by examining a more diverse array of GIS-measured BE features than previously reported, including not only walkability-related features but also access to public transit, parks, and recreation facilities. It also builds upon previous work by the current authors relating LPA-derived profiles of objectively measured BE features to PA in younger adults³⁹ and work examining how profiles of self-reported BE features relate to PA among younger adults^{22,37,46} and older adults²². Using seven diverse BE features, we derived three meaningful BE profiles with varying levels of activity-supportiveness. The profile corresponding to neighborhoods relatively unsupportive of PA comprised the most participants, while the profile corresponding to activity-supportive neighborhoods comprised the fewest. This finding, reflected in other analyses^{22,39,46}, is consistent with low population densities and levels of transit and recreation access seen in U.S. cities, compared to cities in other countries.^{19,47,48}

PA measures and BMI varied as expected in a gradient relation to the activity-supportiveness of neighborhood profiles. Participants in the least PA-supportive profile (L-L-L) consistently had lower levels of PA, and higher levels of sedentary time, than those in the most supportive profile (H-H-H). Differences between those in the moderately supportive profile (M-M-M) and those in the other profiles, however, were generally not significant. Average BMI values, while ordered as expected across profiles, did not significantly differ from each other.

In the quadrant-based analysis of SNQLS participants, those from high versus low (GIS-measured) walkability neighborhoods (defined by a 4-component walkability index at the block group level) differed by 2.5 min/day for accelerometer-measured MVPA, 31.4 min/week for self-reported active transportation (included walking, jogging/running, and biking), and by 0.9 points for BMI.²⁷ For MVPA min/day, self-reported time spent in active transportation (even with biking excluded), and BMI, the differences between the least and most activity-supportive profiles in the current analyses were nearly 2–3 times as large as the differences between walkability groups in the quadrant-based SNQLS analyses.

Potential alternative explanations for differences between the current findings and the quadrant-based findings include: (a) different operationalizations of neighborhood (1-km network buffer vs. Census block group)—areas defined by block group boundaries may be divided by barriers (e.g., freeways, rivers) rendering certain BE features inaccessible, and exclude features that are near a person's home, but lie within an adjacent block group; (b) inclusion of transit, parks, and recreation facilities allowing for more complex BE patterns to emerge, offering a more complete portrayal of a neighborhood feature patterns; (c) differences between LPA grouping of BE features vs. *a priori* construction of feature combinations; or (d) some combination of these components.

Discussions of successful “aging in place”, i.e., older adults maintaining high levels of independence and quality of life without having to move out of their homes, now incorporate the BE surrounding the home (see⁴⁹ for a review). The neighborhood environment becomes particularly important for adults no longer in the workforce, with its impact magnified as

mobility decreases due to physical disablement and/or loss of driving skills, heightening the relevance of proximity to destinations reachable without reliance on walking long distances, driving a private vehicle, or using limited-access public transit (e.g., “Dial-A-Ride”) programs. Designing communities with activity-supportive features or incorporating additional features into existing communities is especially important to an aging population because of the cost and risks associated with the relocation of older adults.⁵⁰ These improvements can also increase home values and decrease expenses related to car ownership, which can ease financial burdens associated with transition to an assisted living or long-term care facility, when or if it becomes necessary.^{51,52}

Study strengths included a large sample of older adults from two regions in the US, objective measures of diverse neighborhood BE features, use of objective and self-reported outcomes in analyses. Limitations included a cross-sectional design and an inherent inability to establish causal relationships. Objective microscale features (e.g., sidewalk quality, safety from traffic) that could not be measured at the same geographic scale could have changed profile patterns. Based on U.S. Census estimates for adults aged 65 and older⁵³, this sample was relatively highly educated, so caution may be warranted in generalizing these findings. Residential self-selection may attenuate relationships between BE features and health outcomes. While we did not adjust for residential self-section, this sample of older adults, on average, lived in their neighborhoods for over 24 years, mitigating this potential bias.

Conclusions

The results reported here add to an accumulating body of findings showing more comprehensive BE characterizations, as compared those relying on individual BE features, may better account for between-neighborhood differences in PA among older adults, indicating that local planning and policy decisions promoting healthy aging in place for this rapidly growing group should be informed by consideration of multiple BE features.

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Highlights

- Latent profile analysis used to identify patterns of seven GIS-measured built environment features.
- Three built environment feature profiles differing in activity-supportiveness emerged.
- Older adults in most activity-supportive profile showed highest levels of MVPA.
- Older adults in most activity-supportive profile showed highest levels of walking for errands and exercise.
- Walkability plus transit and recreation access may contribute to healthy aging.

Figure 1.

Patterns of latent profile analysis-estimated indicators means from 3-profile solution for older adults sampled from the Seattle-King County, WA and Baltimore, MD-Washington, DC regions 2005–2008. A z-score of +1.0 reflects an estimated mean that is 1 SD above the observed sample mean for that indicator. L-L-L = low walkability, low transit access, and low recreation access; M-M-M, medium levels of walkability, transit access, and recreation access; H-H-H, high levels of walkability, transit access, and recreation access.

Figure 2.

Adjusted geometric means for accelerometer-derived MVPA and adjusted arithmetic means for sedentary time by latent profile for older adults sampled from the Seattle-King County, WA and Baltimore, MD-Washington, DC regions 2005–2008. MVPA and sedentary minutes per day values were adjusted for accelerometer wear time, sex, age, race/ethnicity, annual household income, educational attainment, number of motor vehicles and eligible drivers in household, marital or cohabitation status, number of people in household, and years at current address. Within each panel, non-significant comparisons are reflected across profiles by bars with matching colors or matching patterns.

Figure 3.

Adjusted geometric means for CHAMPS-based measures of walking for errands and walking for exercise by latent profile for older adults sampled from the Seattle-King County, WA and Baltimore, MD-Washington, DC regions 2005–2008. Mean were adjusted for accelerometer wear time, sex, age, race/ethnicity, annual household income, educational attainment, number of motor vehicles and eligible drivers in household, marital or cohabitation status, number of people in household, and years at current address. Within each panel, non-significant comparisons are reflected across profiles by bars with matching colors or matching patterns.

Table 1

Percentages, Means, and Standard Deviations for Sample Characteristics for Older Adults from the Seattle-King County, WA and Baltimore, MD-Washington, DC Regions 2005–2008

Variable	Percent	<i>M</i>	<i>SD</i>
Participant background characteristics			
Age (in years)		74.5	6.3
% Female	52.1		
% Non-Hispanic White	70.3		
Highest education level			
Less than high school diploma/GED	5.5		
Completed high school	15.6		
Some college or vocational training	29.8		
Completed college or university	26.1		
Completed graduate degree	23.1		
% Married or cohabiting	56.8		
Annual income (in \$1000)		40–49 ^a	20–29, 70–79 ^b
Vehicles per adults in household		0.9	0.4
Number of people in household		1.8	0.8
Time at current residence (in years)		24.8	15.5
BMI		26.5	4.8
Accelerometer measures			
Sedentary time (minutes/day)		561.4	100.8
Low light PA (minutes/day)		222.4	68.1
High light PA (minutes/day)		29.8	21.5
MVPA (minutes/day)		13.6	16.8
CHAMPS-based measures ^c			
Walking for errands (hours/week)		0.6	1.3
Walking for exercise (hours/week)		3.4	4.1
GIS-measured BE features			
Residential density		7.4	6.0
Intersection density		63.1	23.0
Land use mix		0.2	0.3
Retail floor area ratio		0.2	0.2
Transit stop density		15.6	10.6
Park density		2.4	2.1
Recreation facility density		3.4	4.9

Notes.

^aMedian response.

^b25th and 75th percentiles.

^cCHAMPS—Community Healthy Activities Model Program for Seniors questionnaire