Original Contribution

A Disadvantaged Advantage in Walkability: Findings From Socioeconomic and Geographical Analysis of National Built Environment Data in the United States

Katherine E. King* and Philippa J. Clarke

* Correspondence to Dr. Katherine E. King, Environmental Public Health Division, Environmental Protection Agency, 104 Mason Farm Road, Chapel Hill, NC 27599 (e-mail: kk183@duke.edu).

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Urban form—the structure of the built environment—can influence physical activity, yet little is known about how walkable design differs according to neighborhood sociodemographic composition. We studied how walkable urban form varies by neighborhood sociodemographic composition, region, and urbanity across the United States. Using linear regression models and 2000–2001 US Census data, we investigated the relationship between 5 neighborhood census characteristics (income, education, racial/ethnic composition, age distribution, and sex) and 5 walkability indicators in almost 65,000 census tracts in 48 states and the District of Columbia. Data on the built environment were obtained from the RAND Corporation’s (Santa Monica, California) Center for Population Health and Health Disparities (median block length, street segment, and node density) and the US Geological Survey’s National Land Cover Database (proportion open space and proportion highly developed). Disadvantaged neighborhoods and those with more educated residents were more walkable (i.e., shorter block length, greater street node density, more developed land use, and higher density of street segments). However, tracts with a higher proportion of children and older adults were less walkable (fewer street nodes and lower density of street segments), after adjustment for region and level of urbanicity. Research and policy on the walkability-health link should give nuanced attention to the gap between persons living in walkable areas and those for whom walkability has the most to offer.

built environment; census tracts; health disparities; sociodemographic factors; urban form; walkability

Editor’s note: An invited commentary on this article appears on page 26, and the authors’ response appears on page 30.

IMPORTANCE OF WALKABLE BUILT ENVIRONMENTS

In the last 2 decades, interest has grown in understanding how the built environment can promote healthier lifestyles. Broadly, the built environment refers to aesthetic, physical, and functional qualities of land-use patterns, buildings, and streetscapes that together provide opportunities for physical activity and active transport (1). A considerable body of literature documents the links between urban form and physical activity, such as a street connectivity pattern that fosters walking (2–5), access to recreational spaces (6–9), and walkable nearby commercial destinations (10–13). Large areas devoted to residential land use have fewer nearby destinations and are therefore characterized by less walking and biking and more driving and other forms of passive transport. Neighborhood designs allocating significant space to parking and to land-use patterns in which commercial destinations are not integrated with residential land use, including those found in conventional suburban areas, encourage use of cars rather than public transportation or walking. Thus, by influencing physical activity, land-use patterns may contribute to population obesity (2, 14) and other conditions linked to lack of physical activity, such as depression (15) and inflammation (16). Promoting low-cost physical activities (e.g., walking) among disadvantaged persons is seen as one route to reducing health disparities (17). Simple interventions such as construction of sidewalks and bike lanes, as well as larger-scale changes to urban transit patterns, are a major policy priority for health policy researchers (2, 18, 19).

Urban land-use configuration also can present direct risks for chronic disease and stress—such as exposure to air pollution (20, 21), traffic (22), noise (23), and higher small-area
ambient temperatures (24). Air pollution exposures are higher in disadvantaged communities (20, 25–29). Compared with “urban sprawl,” compact, intensive, mixed-use environmental designs are likely to reduce regional air pollution through reduced vehicle usage, but density can increase traffic congestion even with reduced vehicle usage, concentrating harmful emissions (30) and the resultant risks of respiratory and cardiovascular disease (31, 32). Traffic-related ambient stressors such as noise, poor air quality, and perceived traffic danger are associated with lower health status and higher levels of depression (33) and cynical hostility (34) and could affect cognitive development in children (35). Compact urban design is a policy target, both to reduce global warming and to reduce traffic stress and pollution-related disease risk (30, 33, 36–39).

Mixed land uses, such as the placement of shops near housing, deter crime and social disorder by facilitating “eyes on the street” (40), a neighborly social interaction in which residents both observe and participate in activities occurring on their streets. Some evidence suggests that walkable neighborhoods offer higher levels of neighborhood social ties, trust, and civic participation (41, 42) and may be more socially diverse (43), suggesting that interaction may foster social tolerance. For instance, neighborhoods with more high- and low-rise apartments, as opposed to single-family homes, experience less social interaction (44); similar relationships exist between housing and crime (45). Urban designs fostering casual social interaction may also facilitate neighborhood improvements, the spread of health information, and the provision of neighborly care and social support (46–49).

Relationships between urban form and neighborhood socioeconomic composition are probably complex. Evidence suggests that low-income and minority neighborhoods have worse aesthetics (50, 51), along with fewer parks and recreational facilities (52–55). On the other hand, disadvantaged neighborhoods may have higher levels of walkable urban form, given that street connectivity is higher in high-poverty areas (56). However, to our knowledge, there is no literature documenting relationships between walkable urban form and neighborhood composition at the national level in the United States. Spatial clustering of poverty and racial minorities within US cities has been relatively persistent; disadvantaged communities differ considerably from affluent neighborhoods in terms of the desirability of land uses (57). Indeed, research on how cities evolve shows that urban planning and real estate development interests play a part in continuing racial/ethnic and income segregation (58, 59). Zoning ordinances prescribing low density and separation of residences from other land uses tend to result in highly affluent and typically white sociodemographic compositions (60, 61), often intentionally. Thus, community built environment and social composition are inherently interdependent (62). Disadvantaged urban areas contain fewer food outlets and recreational opportunities and less retail development, and they have higher traffic-accident rates near schools and higher levels of air pollution (8, 27, 63). Knowing whether health risks in disadvantaged communities exist in spite of high walkability or result from low walkability would aid in the design of policy interventions. Walkability is a target for reducing health disparities (25, 55, 64, 65), but if targeted populations already live in more walkable neighborhoods, the issue may be complex. A walkable neighborhood design is probably a resource for otherwise disadvantaged populations—an example of the kind of positive health capacity that researchers have sought to identify to combat a negative focus on health risks in disadvantaged areas. For instance, socially deprived areas in New Zealand have more walkable features (7, 66). However, it has not been established nationwide in the United States that disadvantaged neighborhoods typically have more walkable urban form. The creation of urban designs amenable to active transport and sustainable lifestyles is a key opportunity to promote well-being across a variety of dimensions by providing a resource which is already known to be in demand among disadvantaged populations. Identifying situations where lack of walkable urban form compounds disadvantage (as in depopulated Rust Belt areas, which often lack public transit) may benefit proposals for intervention. In other cases, researchers may find that active transport is low despite walkable urban form, and thus they may need to direct attention to other aspects of walkability, such as destinations, safety, aesthetics, and street accessibility.

In this paper, we describe how walkable built environments in the United States vary by neighborhood sociodemographic composition, region, and urbanicity. We investigated the relationship between 5 neighborhood characteristics (income, education, racial/ethnic composition, age distribution, and sex) and 5 indicators of walkable urban form, using data from more than 63,000 US Census tracts in all 48 coterminous states and the District of Columbia for the year 2000. Based on the limited amount of existing literature, we hypothesized that socioeconomically disadvantaged (lower income and education) and minority neighborhoods would be more walkable than more affluent census-tract neighborhoods with higher proportions of non-Hispanic white residents. A lack of research on the age and sex composition of walkable neighborhoods precluded any a priori hypotheses about these specific relationships, so our analyses in this area are primarily descriptive. We also anticipated differences by region and urbanicity. More generally, we aimed to provide new insight into how land use and street connectivity are differentially experienced by persons in different types of neighborhoods.

METHODS

National data were obtained from multiple sources (as described under each heading below) and were linked at the census-tract level. The study area comprised all 64,885 US Census tracts in the 48 coterminous states and the District of Columbia, including 3,100 nontracted county-level locations (e.g., counties/parishes/boroughs). Data from 2000–2001 were the most recent in which both connectivity and land-use data were available nationwide. Information on walkable built environments across the United States is often recorded at the municipal or regional level using different methods, so we were limited to assessing street connectivity and land-use intensity in the present analysis.

Walkable urban form

Street connectivity and land-use intensity are 2 key dimensions of walkability. Smaller blocks and a greater density of
streets and intersections (nodes) are considered to be quantifiable, clear, and correlated features which can aid pedestrian navigation. Our 3 measures of connectivity came from calculations of national tract-level street connectivity measures made by the RAND Corporation’s (Santa Monica, California) Center for Population Health and Health Disparities (67): median block perimeter length (feet), street segment density (number of segments per square mile), and street node density (number of nodes per square mile) (1 mile = 1.609 km). These measures were based on the US Census Bureau’s 108th CD Census 2000 TIGER/Line Files (using TIGER/TOOL) and were computed with ArcGIS software, version 9.1 (68). Segments are the road length between 2 nodes. Pseudonodes (road line breaks in the map which give a false impression of a node) were removed. Nodes on tract boundaries were assigned only to the tract they fell within. Blocks were assigned to the tract in which their centroids fell. Some tracts had unusually high values for median block length, street segment density, and street node density, and these variables were recoded to a maximum value 2 standard deviations above the mean, which sensitivity analyses showed did not substantively affect results. Some tracts had missing values on street connectivity (1,457 for median block length, 496 for node density, and 496 for segment density) and were excluded from analyses. We used ArcGIS 9.1 and a built-in ESRI street map (ESRI, Redlands, California) Center for Population Health and Health Disparities’ 2001 National Land Cover Database (69–71). We fitted the land-cover data to US Census tracts by performing a spatial join with a census-tract polygon shapefile in ArcGIS and assessing the total amount of land area in each tract allocated to each land-cover classification. Two land-cover classes are of particular interest for health research: developed open space and high-intensity developed space. Unlike undeveloped areas, developed open space has some construction but primarily grass and other vegetation. High-intensity development includes areas where impervious surfaces account for 80%–100% of the total cover; these areas tend to have high population density and/or commercial/industrial activity. These areas are high-intensity in that most land is covered in buildings or pavement. Use of this satellite-based measure is an innovation in that it makes it possible to examine land use across the entire United States. However, this measure does not enable researchers to distinguish among residential, commercial, industrial, and other land uses.

Population characteristics

Demographic measures came from the 2000 US Census (72). Four measures of socioeconomic status were used: median annual family income, percentage of households living in poverty, and percentages of the population aged ≥25 years with less than 12 years of education and greater than 16 years of education. Racial/ethnic composition was based on the percentages of persons who were Hispanic, non-Hispanic black, non-Hispanic Asian/Pacific Islander/Native American, non-Hispanic other, and (the reference category) non-Hispanic white. The percentages of the population who were foreign-born, female (among persons aged ≥25 years), and aged <18 years or ≥65 years were also included.

Geographical descriptors

We also included indicators of geographical divisions within the United States. Binary indicator variables were used to represent the 9 US Census divisions (New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and (the reference division) Pacific) to characterize urbanicity as micropolitan, small town, rural, or (the reference category) metropolitan, based on primary commuting flows (the 2000 Rural-Urban Commuting Area Codes (73)). Micropolises have a population of 10,000–49,999, while small towns have a population of 2,500–9,999. Twenty-three census tracts lacked urbanicity codes and were excluded.

Statistical analysis

We used linear regression models to examine the associations between aspects of walkable community design and neighborhood sociodemographic characteristics, considering region and urbanicity. Specifically, for percentage of high-intensity development, percentage of developed open space, median block length, street segment density, and street node density, we fitted regression models to assess the association between each of these 5 built environment measures and census tract social composition, adjusted for urbanicity and region. We used Stata, version 12.1 (StataCorp LP, College Station, Texas) (74), in all models.

RESULTS

Table 1 shows the characteristics of US Census tracts with respect to walkable urban form and social composition. Approximately 9% of land area at the census-tract level is highly developed, while 12% is developed open space. On average, census tracts have 149 street segments and 110 intersection nodes per square mile and a median block length of 3,195 feet (0.97 km). Each measure has considerable variance around the mean. The regression results showed significant differences in connectivity and land use according to neighborhood sociodemographic characteristics, adjusted for urbanicity and region (Table 2). Model $R^2$ statistics were relatively high, demonstrating that 19%–50% of the variance in neighborhood walkability could be explained by tract-level sociodemographic and geographical characteristics. After adjustment for covariates, the results showed notable differences in walkability by neighborhood racial/ethnic, nativity, education, income, sex, and age composition. For all outcomes, census tracts with higher proportions of non-Hispanic blacks, Hispanics, Asians/Pacific Islanders/Native Americans, and non-Hispanic others were advantaged in comparison with non-Hispanic white neighborhoods with respect to walkability. For instance, a
1% increase in the proportion of black residents in a tract was associated with a 0.035% increase in high-intensity development, a 0.011% increase in the proportion of open space, a reduction in block length of 1,057 feet (0.32 km), 85.7 more nodes per square mile, and 122.5 more street segments per square mile.

However, Hispanic neighborhoods were significantly less intensely developed than non-Hispanic white neighborhoods. There were no differences between Asian/Pacific Islander/Native American and non-Hispanic white neighborhoods in terms of street node density and street segment density, or between non-Hispanic other and non-Hispanic white neighborhoods in terms of the proportion of open space.

Neighborhoods with more immigrants were more walkable, but they also had less open space. For example, a 1% increase in foreign-born residents in a tract was associated with blocks that were 360.5 feet (0.11 km) shorter, that had 156.9 more street nodes per square mile, and that had 199.7 more segments per square mile, along with a 0.5% increase in high-intensity development and a 0.156% decrease in open space.

An increasing educational gradient in open space emerged, where tracts with highly educated residents had more developed open space. However, for the other 4 walkability outcomes, neighborhoods with more residents with less than a high school education, as well as those with more college-educated residents, had greater walkability. Except for open space, this suggests a nonlinear U-shaped relationship between walkability and education, such that the most disadvantaged and the most advantaged neighborhoods are the most walkable, while the typical middle-class majority lives in neighborhoods that are the least walkable.

Tracts with more residents in poverty were more walkable (shorter block length, greater street node density, higher density of street segments), but there was less open space. However, the reverse pattern held for income—tracts with a higher median family income were less walkable (longer block length, fewer street intersections (nodes) and segments) but had more developed open space.

Tracts with more children and seniors were less walkable, with more open space, except that areas with more seniors had smaller blocks. Tracts with more women were more walkable, with more open space. Metropolitan tracts were more walkable and had more developed open space than micropolitan, small-town, or rural tracts, except that micropolises and small towns had smaller median block lengths. Most tracts were metropolitan, and many were suburban. In stratified analyses, the overall findings were quite similar to the findings for metropolitan and suburban tracts (results not shown). Further research is needed to focus on rural areas. There was little high-intensity development in rural tracts, for instance. Regional differences also appeared for each outcome, suggesting that further research on how and why built environments vary by region may be helpful in contextualizing results from multiple studies.

Bivariate associations tended to line up with findings from the multivariable models. We examined variance inflation factors and found no multicollinearity. The outcome variables were approximately normally distributed, and no substantive differences were found when we used Poisson models for count data.

**DISCUSSION**

Relationships between social composition and neighborhood walkable urban form are complex. Our results indicate
Table 2. Population and Geographical Predictors of Walkable Urban Form (Change per Percentage Point) in the 48 Coterminous US States and the District of Columbia, 2000

<table>
<thead>
<tr>
<th></th>
<th>% High-Intensity Development</th>
<th>% Developed Open Space</th>
<th>Median Block Length, feet&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Street Node Density, no. per square mile&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Street Segment Density, no. per square mile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>P Value</td>
<td>β</td>
<td>P Value</td>
<td>P Value</td>
</tr>
<tr>
<td>Social Composition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity, % of population&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>0.0348</td>
<td>&lt;0.00001</td>
<td>0.0107</td>
<td>&lt;0.00001</td>
<td>−1,056.97</td>
</tr>
<tr>
<td>Hispanic</td>
<td>−0.0362</td>
<td>&lt;0.00001</td>
<td>0.0879</td>
<td>&lt;0.00001</td>
<td>−1,699.20</td>
</tr>
<tr>
<td>Non-Hispanic Asian/Pacific Islander/Native American</td>
<td>−0.0513</td>
<td>&lt;0.00001</td>
<td>0.0204</td>
<td>0.0018</td>
<td>269.79</td>
</tr>
<tr>
<td>Non-Hispanic other</td>
<td>1.1638</td>
<td>&lt;0.00001</td>
<td>0.0618</td>
<td>0.0376</td>
<td>−14,159.04</td>
</tr>
<tr>
<td>% foreign-born</td>
<td>0.4999</td>
<td>&lt;0.00001</td>
<td>−0.1561</td>
<td>&lt;0.00001</td>
<td>−360.48</td>
</tr>
<tr>
<td>Education, % of population aged ≥25 years&lt;sup&gt;e&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 years</td>
<td>0.1651</td>
<td>&lt;0.00001</td>
<td>−0.1103</td>
<td>&lt;0.00001</td>
<td>−839.93</td>
</tr>
<tr>
<td>&gt;16 years</td>
<td>0.0138</td>
<td>0.0333</td>
<td>0.1526</td>
<td>&lt;0.00001</td>
<td>−2,577.35</td>
</tr>
<tr>
<td>% of families living in poverty</td>
<td>0.3423</td>
<td>&lt;0.00001</td>
<td>−0.0212</td>
<td>0.0045</td>
<td>−1,355.50</td>
</tr>
<tr>
<td>Median annual family income, dollars</td>
<td>−0.0015</td>
<td>0.0008</td>
<td>0.0040</td>
<td>&lt;0.00001</td>
<td>105.05</td>
</tr>
<tr>
<td>% aged &lt;18 years</td>
<td>−0.7685</td>
<td>&lt;0.00001</td>
<td>0.2742</td>
<td>&lt;0.00001</td>
<td>6,178.61</td>
</tr>
<tr>
<td>% aged ≥65 years</td>
<td>−0.2587</td>
<td>&lt;0.00001</td>
<td>0.2560</td>
<td>&lt;0.00001</td>
<td>−1,168.27</td>
</tr>
<tr>
<td>% female (among persons aged ≥25 years)</td>
<td>0.0718</td>
<td>&lt;0.00001</td>
<td>0.0368</td>
<td>0.0015</td>
<td>−8,318.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity&lt;sup&gt;f&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micropolitan</td>
<td>−0.0395</td>
<td>&lt;0.00001</td>
<td>−0.0302</td>
<td>&lt;0.00001</td>
<td>566.29</td>
</tr>
<tr>
<td>Small town</td>
<td>−0.0494</td>
<td>&lt;0.00001</td>
<td>−0.0572</td>
<td>&lt;0.00001</td>
<td>778.80</td>
</tr>
<tr>
<td>Rural</td>
<td>−0.0506</td>
<td>&lt;0.00001</td>
<td>−0.0829</td>
<td>&lt;0.00001</td>
<td>2,613.44</td>
</tr>
<tr>
<td>Region&lt;sup&gt;g&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New England</td>
<td>0.0703</td>
<td>&lt;0.00001</td>
<td>−0.0064</td>
<td>0.0045</td>
<td>−297.97</td>
</tr>
<tr>
<td>Middle Atlantic</td>
<td>0.1268</td>
<td>&lt;0.00001</td>
<td>0.0292</td>
<td>&lt;0.00001</td>
<td>−251.30</td>
</tr>
<tr>
<td>East North Central</td>
<td>0.0723</td>
<td>&lt;0.00001</td>
<td>0.0228</td>
<td>&lt;0.00001</td>
<td>0.65</td>
</tr>
<tr>
<td>West North Central</td>
<td>0.0749</td>
<td>&lt;0.00001</td>
<td>0.0125</td>
<td>&lt;0.00001</td>
<td>174.86</td>
</tr>
<tr>
<td>South Atlantic</td>
<td>−0.0006</td>
<td>0.7601</td>
<td>0.0858</td>
<td>&lt;0.00001</td>
<td>−48.04</td>
</tr>
<tr>
<td>East South Central</td>
<td>0.0125</td>
<td>&lt;0.00001</td>
<td>0.0822</td>
<td>&lt;0.00001</td>
<td>338.01</td>
</tr>
<tr>
<td>West South Central</td>
<td>0.0329</td>
<td>&lt;0.00001</td>
<td>0.0387</td>
<td>&lt;0.00001</td>
<td>49.72</td>
</tr>
<tr>
<td>Mountain</td>
<td>0.0389</td>
<td>&lt;0.00001</td>
<td>−0.0200</td>
<td>&lt;0.00001</td>
<td>−200.99</td>
</tr>
<tr>
<td>Constant</td>
<td>0.1045</td>
<td>&lt;0.00001</td>
<td>−0.0469</td>
<td>&lt;0.00001</td>
<td>6,865.04</td>
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<tr>
<td>R²</td>
<td>0.47</td>
<td>0.24</td>
<td>0.19</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>No. of census tracts</td>
<td>64,437</td>
<td>64,437</td>
<td>63,089</td>
<td>63,972</td>
<td>63,972</td>
</tr>
</tbody>
</table>

<sup>a</sup> Derived from regression models.

<sup>b</sup> 1 foot = 0.305 m.

<sup>c</sup> 1 mile = 1.609 km.

<sup>d</sup> Reference group: % non-Hispanic white.

<sup>e</sup> Reference group: % aged ≥25 years with 12–16 years of education.

<sup>f</sup> Reference group: metropolitan.

<sup>g</sup> Reference group: Pacific.
that census tracts with socioeconomically disadvantaged populations, as well as those with more educated residents, tend to have urban form which is more walkable, while less walkable areas are home to more children and seniors (groups who might especially benefit from walkability). Prior research has mostly assumed that disadvantaged areas are worse-off along multiple dimensions (75). Obstacles for the socially disadvantaged have been shown for other dimensions of the built environment, such as access to food stores and places to exercise (50). However, assuming that disadvantaged neighborhoods are always less walkable might distract attention from walkable urban form as a strength of some low-income and minority areas. Meanwhile, given recent attention to walkability as a key need for seniors (76), the finding that older adults tend to live in areas with less walkable urban form deserves greater awareness. Likewise, safe and navigable streets are especially important for children’s physical activity and adolescent safe exploration. Motor vehicle crashes are the leading cause of death among children under age 5 years (77), suggesting that youth mortality is sensitive to community design and transit options. Unfortunately, the present tendency of minors to live in low-walkability areas may conversely tend to reinforce driving as a social norm as today’s children grow to adulthood.

We addressed a limited number of built environment measures on which data were available nationally. Many other aspects of the built environment may promote physical activity and active transport, such as proximity to destinations, transit, sidewalks, perceived crime and traffic safety, aesthetics, recreational sites, parking, and maintenance. Most of these measures are difficult to assess uniformly across the nation. For local analyses of physical activity and active transit designed to assess how changing the built environment might foster walking, it would be preferable to use a broad range of very detailed measures. Our goal is to provide some national measures and examine differential assortment by local social and age composition, as well as by urbanicity and region. For this goal, less detailed data are available, but the measures we used would make a good start.

This research had limitations. Given the large number of census tracts, most regression coefficients were significant at $P < 0.05$, obscuring which associations were most policy-relevant. Unfortunately, the last year for which all measures were available was 2000, and the nature of changes over time is as yet unclear. We did not test whether or how our urban-form indicators predicted walking. Models which included adjustment for spatial autocorrelation did not converge. Thus, consideration of region and urbanicity may not have been sufficient in adjusting for spatial autocorrelation. We make no causal claims that demographic factors drive urban form/land use or vice versa; rather, we report cross-sectional associations. In future work, investigators should discuss how links between urban form/land use change longitudinally and how members of social groups sort or are steered into residential choices. Another issue is heterogeneity in associations by region and urbanicity.

Urban form walkability has implications for health disparity policy. The importance of the physical environment in determining health is underscored by a considerable number of studies suggesting that characteristics of neighborhood physical form provide opportunities for health interventions that can support healthy behaviors, reduce health disparities, and improve social relations (12, 23, 43, 78–82). Moreover, the existence of regional differences for each outcome suggests that further research on how and why built environments vary by region may be helpful in contextualizing results from multiple studies.

Residents of disadvantaged neighborhoods, given that they tend to lack resources which reduce dependency on the neighborhood (e.g., cars or social ties outside the neighborhood), may benefit more from neighborhood designs that make health and recreational resources, jobs, and civic opportunities easy to access by walking. These findings suggest an opportunity to address transportation and physical activity disparities by focusing on changes to malleable urban features such as crime, shade, snow/ice removal, aesthetics, noise, and pollution—without having to tear down and rebuild cities in order to produce walkable environments. Finer-scale improvements such as sidewalks, medians, crosswalks, crossing signals, and ramps, along with routine maintenance, have been recommended to aid pedestrians and promote transportation inclusivity (83) and are particularly beneficial for residents with functional limitations (84).

An understanding of the dynamic relationship between urban form and neighborhood composition would lend further insight into the implications of urban planning policy for neighborhood change. Until the post–World War II construction boom, all urban areas were basically walkable by necessity. Drivable suburban forms are a relatively recent phenomenon, and to some extent an artifact of a particular version of the “American Dream” bound in the experience of a certain time period. Disinvestment and the decline of walkable urban areas went hand in hand with “white flight” and processes of racial segregation. Today, research indicates that demand for housing in walkable metropolitan areas far exceeds supply (85). Given that walkable urban form is seen as a means of promoting social interaction and diversity (86, 87), these changing tastes in housing may represent an opportunity to foster integration for American Indians, just as suburban conditions facilitated white ethnic assimilation (88, 89). (Indeed, some researchers believe that the spatial patterning of barriers to walking, such as railroads [90], highways, and major roads, was literally the foundation of US residential segregation.)

Public health researchers have been calling for infill development and sprawl reduction to increase physical activity, reduce vehicle emissions, and improve air quality and respiratory health. However, changing policies might have a side effect of increasing the number of persons exposed to unfavorable conditions such as poor air quality (20), and to our knowledge no prior national US-based study has established the sociodemographic composition of persons exposed to walkable urban form versus car-friendly urban form. Capitalizing on the opportunity to change urban development policies during a time of changing lifestyles and thereby promoting diverse social ties, physical activity, respiratory health, and sustainable living will require a greater understanding of how urban form relates to the socioeconomic characteristics of particular places. In the current study, we aimed to contribute to closing this gap.
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Author affiliations: Environmental Public Health Division, Environmental Protection Agency, Chapel Hill, North Carolina (Katherine E. King); Department of Community and Family Medicine, Duke University School of Medicine, Durham, North Carolina (Katherine E. King); Population Studies Center, University of Michigan, Ann Arbor, Michigan (Philippa J. Clarke); and Survey Research Center, University of Michigan, Ann Arbor, Michigan (Philippa J. Clarke).

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