HHS Public Access

Author manuscript

Prev Med. Author manuscript; available in PMC 2021 October 25.

Published in final edited form as:

Prev Med. 2020 August ; 137: 106122. doi:10.1016/j.ypmed.2020.106122.

Associations between the National Walkability Index and walking among US Adults — National Health Interview Survey, 2015

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Abstract

The Environmental Protection Agency created the National Walkability Index (Index) to compare and analyze walkability among US communities. Index elements include design, distance to transit, and diversity of land uses. Associations between the Index and walking behavior have not been examined. This study describes associations between the Index and transportation and leisure walking among US adults. Past week self-reported participation in transportation and leisure walking among adults (n = 33,672) was obtained from the 2015 Cancer Control Supplement of the National Health Interview Survey (NHIS) and analysis completed in 2019. Index scores were linked to NHIS data based on the respondent's residence and classified into least, below average, above average, and most walkable communities. Associations between Index categories and walking were examined with regression models. Overall, the Index was associated with a higher likelihood of walking, especially for transportation. Transportation walking was more common in areas with higher walkability (21.6%–51.6%, least to most walkable). Leisure walking was also more common with greater walkability (48.4%–56.5%, least to most walkable). Transportation and leisure walking by Index categories in urban areas were similar to the overall population; however, it was not associated with walking in rural areas. US adults living in more walkable

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Disclosure statement

No conflicts of interests or financial disclosures were reported by the authors of this paper.

Credit authorship contribution statement

Kathleen B. Watson: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Geoffrey P. Whitfield:** Methodology, Writing - review & editing. **John V. Thomas:** Methodology, Data curation, Writing - review & editing. **David Berrigan:** Methodology, Writing - review & editing. **Janet E. Fulton:** Methodology, Writing - review & editing. **Susan A. Carlson:** Methodology, Writing - review & editing.

areas report more transportation and leisure walking, especially among urban areas. Consistent with elements in the Index, associations were stronger for transportation than leisure walking. Findings support the use of the Walkability Index by researchers, professionals, and other relevant stakeholders as a viable indicator of walkability.

Keywords

Built environment; Neighborhood; Walking; Walkability

1. Introduction

Despite the benefits of being physically active, 46% of US adults did not report enough activity to meet the federal aerobic physical activity guideline in 2018 (Villarroel et al., 2019). One way to increase physical activity is through increased walking, regardless of whether the purpose is for transportation (to get from place to place) or leisure (for fun, exercise, or relaxation). *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* calls on Americans to be physically active and for the nation to better support walking and walkability for everyone (U.S. Department of Health and Human Services, 2015). Improving walkability means communities are created or enhanced to make it safe and easy to walk, and pedestrian activity is encouraged for everyone (Federal Highway Administration, 2008). Communities can implement multiple strategies to help promote walkability, such as improved community design and supportive programs, policies, and practices (Community Preventive Services Task Force, 2016).

Easy access to data on walkability can help guide public health, transportation, and planning efforts to promote walking and walkability. In 2017, the Environmental Protection Agency (EPA) created the National Walkability Index (Index) to make it easier for people to examine, analyze, and compare neighborhood walkability using a free, easily accessed, and transparent metric (Thomas and Zeller, 2017). The Index includes three elements—design, distance to transit, and diversity, which are correlates of walking and commonly used in urban planning and travel research (Ewing and Cervero, 2010). Given the elements contained in the Index (Thomas and Zeller, 2017), we would expect it to be associated with walking; however, no previous studies have examined this association.

Several factors may influence the association between the Index and walking, including walking purpose and urban-rural status. The Index includes elements related to built environment features that affect the likelihood of whether people will walk for transportation (Ewing and Cervero, 2010; Thomas and Zeller, 2017) making it likely the Index will be closely associated with transportation walking. However, it is less clear how the Index is associated with walking for leisure, as it does not capture built environment features more closely associated with leisure walking, such as pedestrian infrastructure and aesthetics (Kang et al., 2017). Additionally, environmental correlates of physical activity, including walking, may differ between urban and rural areas (Kegler et al., 2015; Whitfield et al., 2019). Selection of Index elements was motivated by research on built environment

moderators of travel behavior found in urban planning (Ewing and Cervero, 2010); however, less is known about their usefulness in rural settings for predicting behavior.

Although there are cross-sectional studies examining the association between walkability and walking, to our knowledge, they do not include a large, nationally representative sample or the recently developed, freely accessible, and transparent Index. Therefore, this study sought to: (1) describe the sociodemographic characteristics associated with living in different Index categories and (2) examine the association between the Index and walking for transportation and leisure overall and by urban and rural residences. Understanding the context (transportation or leisure) and areas (urban, rural) the Index associates with walking may be useful to public health and transportation professionals, and other relevant stakeholders, as they analyze and compare their communities' walkability.

2. Methods

2.1. Survey and analytic sample

The National Health Interview Survey (NHIS) is a continuous cross-sectional survey of a random sample of US households (https://www.cdc.gov/nchs/nhis/index.htm). NHIS uses a multistage area probability design to create a nationally representative sample of the non-institutionalized, civilian population. This study used data from the 2015 core questionnaire and the Cancer Control Supplement that included questions on walking. The 2015 NHIS sample adult response rate was 55.2% (National Center for Health Statistics, 2016). The study also used data from EPA's Index database (https://www.epa.gov/smartgrowth/smart-location-mapping)). Use of restricted geocodes (block group identifiers, urban/rural residence) required Index data linked to NHIS data at the Research Data Center. This linkage allowed us to capture information from the block group surrounding where one resides. The Research Ethics Review Board of the National Center for Health Statistics approved all NHIS activities; all participants provided informed consent.

The 2015 NHIS sample size for sample adults aged ≥18 years was 33,672, including the Cancer Control Supplement. Adults who were unable to walk (2.1%) or were missing information on selected characteristics or walking behavior (12.2%) were excluded.

2.2. Measures

NHIS respondents were classified by sex, age group (18–24, 25–34, 35–44, 45–64, or ≥65 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other race), and highest level of education completed (< high school graduate, high school graduate, some college, or college graduate). Census region (Northeast, Midwest, Northeast, South, or West) and residence type (urban or rural) was assigned based on interviewed household location. Urban—rural residence was determined from the Census Bureau's 2010 urban definition, which is primarily based on residential population density and densely developed territory (Ratcliffe et al., 2016). Areas not defined as urban are classified as rural (Ratcliffe et al., 2016).

2.2.1. Transportation and leisure walking—To assess transportation walking, respondents were asked, "During the past 7 days, did you walk to get some place that took

you at least 10 minutes?" To assess leisure walking, respondents were asked, "Sometimes you may walk for fun, relaxation, exercise, or to walk the dog. During the past 7 days, did you walk for at least 10 minutes for any of these reasons? Please do not include walking for transportation." Respondents who reported they walked (walkers) were subsequently asked to report the frequency and average duration of the walks. For walkers, weekly minutes of walking for each domain were calculated by multiplying the frequency by the duration of the walks. Respondents who did not walk or who reported average durations of < 10 min were categorized as nonwalkers.

2.2.2. National walkability index—Community was defined as the block group of the respondent's residence. Community walkability was defined as the block group value from the Index (Thomas and Zeller, 2017). The development of the Index and indicators in the Index (https://www.epa.gov/smartgrowth/smart-location-mapping#walkability) have been previously published and are summarized here (Thomas and Zeller, 2017). The Index ranks block groups according to their relative walkability based on equal weighting of three influences in urban planning (design, distance, and diversity). The Index is based on four indicators: intersection density (design), proximity to transit stops (distance), and a mix of employment and household types (diversity) (Ewing and Cervero, 2010; Hajna et al., 2015; Karmeniemi et al., 2018; Saelens et al., 2003; Thomas and Zeller, 2017; Van Holle et al., 2012). In addition to their association with active transportation, these variables were chosen because data at the block group level is available and consistent. This limited set of variables also helps make the Index simple and easily understood.

To assign the Index score, block groups first were ranked by each indicator into 20 quantiles. Each indicator was then assigned a score from 1 to 20 where 20 corresponded to block groups with the highest relative walkability. The block group ranked score for each indicator was used to calculate the final Index score and were summed as follows: one-third of the block group's ranked score for intersection density (design), one-third of the block group's ranked score for proximity to transit stops (distance), one-sixth of the block group's ranked score for employment mix (diversity), and one-sixth of the block group's ranked score for employment and household mix (diversity). Block groups were then subdivided into the following equal interval categories based on the Index score range (1–20):

- 1.00–5.75 Least walkable
- 5.76–10.50 Below average walkable
- 10.51–15.25 Above average walkable
- 15.26–20.00 Most walkable

2.3. Statistical analysis

Percentages were used to describe Index categories by demographic characteristics (sex, age group, race/ethnicity, education level, and region). Chi-square tests were used to determine whether the Index was associated with demographic characteristics. To determine where the differences were, linear and quadratic contrasts and pairwise *t*-tests were used to identify

significant trends and differences by characteristic within each Index category. Other race/ethnicity was not included in pairwise testing because of subgroup heterogeneity.

Separate models were estimated for transportation and leisure walking. Logistic regression was used to examine associations between walking, a dichotomous variable, and Index categories. Among walkers, linear regression was used to examine associations between weekly walking minutes, a continuous variable, and Index categories. Given the approximate lognormal distribution of weekly walking minutes among walkers, minutes were log-transformed for analyses and subsequently back-transformed when reporting geometric mean minutes. All models adjusted for demographic characteristics and included tests for trends across Index categories. Because of renewed interest in place, e.g., geographic locations, and rural health (Phillips and McLeroy, 2004), analyses were conducted overall and stratified by urban–rural residence. Because no adults lived in the most walkable community category in rural areas, analyses among rural adults were limited to the three lesser categories.

SAS-Callable SUDAAN version 11.0 (Research Triangle Institute, Research Triangle Park, NC) was used for all analyses, completed in 2019, to account for the complex sampling design and to provide weighted estimates. Level of significance was $P \leq 0.05$. Bonferroni adjustments were used for multiple comparisons.

3. Results

3.1. National Walking Index and selected characteristics

There was a significant association between walkability, assessed by the Index, and all characteristics ($P < 0.05$). When examining the distribution of characteristics for each Index category separately, the percentage of adults living in communities within each Index category varied significantly across all selected characteristics overall ($P < 0.05$) (Table 1). The highest percentage of adults living in least walkable communities was among each of the following subgroups: women; adults aged 45 years or older; non-Hispanic white adults (white); adults living in the South; and adults living in rural areas (Table 1). In comparison, the highest percentage of adults living in most walkable communities was among each of the following subgroups: adults aged 44 years or younger; Hispanic adults; adults who did not graduate from high school, or who were a college graduate; and adults living in the Northeast or West.

No adults living in rural areas lived in most walkable communities, and only 1% of adults living in above average walkable communities lived in rural areas (Table 1). When stratified, the percentages of adults living in least to most walkable communities by subgroup in urban areas were similar to the overall group (Fig. 1a). Percentages of adults living in least to above average walkable communities did not significantly vary by subgroup in rural areas (Fig. 1b).

3.2. National Walking Index and walking prevalence

Overall, living in a community with a higher Index score was positively associated ($P < 0.05$) with transportation walking (Table 2). A positive linear trend ($P < 0.05$) in

transportation walking prevalence and the Index was observed ranging from 22% for adults residing in least walkable communities to 52% for adults residing in most walkable communities. After adjusting for selected characteristics, adults living in below average walkable (aOR 1.18 [95% CI 1.05–1.33]), above average walkable (AOR 1.92 [1.66–2.33]), and most walkable (AOR 2.88 [2.43–3.41]) communities were more likely to walk for transportation compared with adults who lived in least walkable communities. Comparable results were observed among adults in urban areas. However, the Index was not significantly associated with transportation walking for adults in rural areas (Table 2).

Similar to the results for transportation walking, the Index was significantly associated with leisure walking prevalence ($P < 0.05$) (Table 2). A positive linear trend ($P < 0.001$) in leisure walking prevalence was observed and ranged from 48% for adults residing in least walkable communities to 57% for adults residing in most walkable communities. After adjusting for selected characteristics, adults living in below average walkable (AOR 1.13 [1.01–1.27]) and most walkable (AOR 1.25 [1.08–1.45]) communities were more likely to walk for leisure compared with adults who lived in least walkable communities. For adults in urban areas, adults living in most walkable communities were more likely (AOR 1.25 [1.06–1.47]) to walk for leisure compared with adults who lived in least walkable communities. The Index was not significantly associated with leisure walking among adults in rural areas (Table 2).

3.3. National Walking Index and walking minutes

Among transportation walkers, the Index was associated ($P < 0.05$) with weekly transportation walking minutes (Table 3). Although weekly minutes was not significantly different among adults living in least walkable (55 min), below average (55 min), and above average walkable communities (61 min), after adjusting for selected characteristics, weekly transportation minutes among adults living in most walkable communities was higher (adjusted ratio = 1.26 [1.13–1.40]; 71 min) than among adults living in least walkable communities. Similar results were observed among adults in urban areas; however, there was no significant association between the Index and weekly minutes of transportation walking among adults in rural areas (Table 3).

Among leisure walkers, weekly geometric mean walking minutes was 79 min among adults living in least walkable, below average walkable, and above average walkable communities (Table 3). However, geometric mean walking minutes (86 min) was higher (adjusted ratio 1.10 [1.01–1.31]) among adults living in most walkable communities compared to adults living in least walkable communities. Similar results were observed among adults in urban areas; however, there was no significant association between the Index and weekly leisure walking minutes among adults in rural areas (Table 3).

4. Discussion

Overall, the National Walkability Index was associated with a greater likelihood of walking, especially for transportation. Similar patterns of walking participation and weekly minutes from least to most walkable communities were observed among adults living in urban areas, although the Index was not significantly associated with walking participation or weekly minutes among adults living in rural areas. Understanding in what context and in what

areas the Index is associated with walking may be useful to public health and other relevant professionals as they assess their communities' walkability (Mayne et al., 2013; Stockton et al., 2016). This study's findings show the Index may help identify areas in which to target policies, practices, or programs aimed at improving walkability (Community Preventive Services Task Force, 2016). Once identified, community engagement and the planning process, which may include further investigation of the influences in urban planning, can occur to determine how to best improve walkability. Practitioners and other stakeholders can use recommended evidence-based built environment strategies that combine transportation with land use and environmental design interventions to improve walkability (Community Preventive Services Task Force, 2016).

Our findings showed variations in the Index by selected characteristics (i.e., adults who were ≤44 years, Hispanic, had less than a high school graduation or who were a college graduate, who were from the North and West, and who resided in urban areas live in most walkable communities) and these were consistent, with few exceptions, with past studies examining subgroup variations in Walk Score (Hirsch et al., 2013; Tuckel and Milczarski, 2015). A panel study found younger adults (aged 25–44 years), non-Hispanic blacks, and adults with lower socio-economic status (annual household incomes less than $30,000) more likely lived in very or extremely walkable communities, as measured by Walk Score (Tuckel and Milczarski, 2015). In contrast, our study found Hispanics more likely lived in most walkable communities. Another study found a higher proportion of females, Hispanics, and adults with lower education levels were located in communities deemed a "Walker's Paradise" than less walkable communities (Hirsch et al., 2013). How the walkability measure was derived provides one possible reason for inconsistencies between this study and others—from urban planning principles (design, distance to transit, and diversity) in this study and by access to amenities (Walk Score) in the other studies (Thomas and Zeller, 2017; Tuckel and Milczarski, 2015). Future research may want to further examine the inconsistency of the literature on socio-demographics patterns across different levels of walkability.

Previous studies examining associations between walkability and transportation walking found similar results to our results overall and for adults residing in urban areas (Hirsch et al., 2013; Reyer et al., 2014; Tuckel and Milczarski, 2015; Vargo et al., 2012; Yang and Diez-Roux, 2017); however, studies examining associations between walkability and leisure walking observed different results (Hirsch et al., 2013; Tuckel and Milczarski, 2015; Yang and Diez-Roux, 2017). For example, a study of US adults in a large metropolitan city used free, publicly available data from Google to measure walkability and found adults in more walkability areas were more likely to make more of their trips by walking (Vargo et al., 2012). A study of German adults found walkability, based on the Neighborhood Quality of Life Study Walkability Index (Frank et al., 2010), to be associated with weekly minutes and trips of transportation walking (Reyer et al., 2014). Other studies also found walkability, measured using Walk Score, positively associated with transportation walking prevalence (Hirsch et al., 2013; Tuckel and Milczarski, 2015; Yang and Diez-Roux, 2017) and minutes per week (Hirsch et al., 2013; Tuckel and Milczarski, 2015; Yang and Diez-Roux, 2017).

Unlike our study, studies that examined the association between walkability, measured using Walk Score, and leisure walking found associations to be either not significant (Tuckel and

Milczarski, 2015; Yang and Diez-Roux, 2017) or in the undesired direction (Hirsch et al., 2013). Lack of positive associations between walkability, using Walk Score, and leisure walking in previous studies is not surprising as more walkable areas, based on greater access to destinations (Walk Score), may not be as relevant or play as important a role to walking for fun, exercise or relaxation as it is to walking to get from place to place. Walkability in this study was based on urban planning elements of which there may be some association with leisure walking (Kang et al., 2017).

We found no significant association between the Index categories, which use a geographic composite measure of diversity, design, and distance to transit, and walking behavior in rural areas. Even with a sensitivity analysis with new Index quartiles based on the Index range in rural areas, we found no significant association. Other studies have not reported on this association; however, a study among rural women found no association between Walk Score and moderate-to-vigorous physical activity (Lo et al., 2019). One reason may be walkability is not associated with walking in rural areas; however, another reason may be the elements in the Index, identified through urban planning research, may not capture elements important to walkability in the rural setting. For these reasons and our finding that 99% of rural-residence was in least walkable or below average walkable areas, examining the association between the Index and walking in rural areas was challenging. Rural settings can also be very heterogeneous in *rurality*, where settings span from small towns to isolated geographic areas (Fan et al., 2015). Furthermore, there may be additional rural-specific barriers to walking to consider. Additional research may help identify elements for developing a rural-based walkability index that could be more closely associated with walking, incorporate differences in rurality, and be useful for practitioners working among rural settings. Future research on effect modification by variables other than urban-rural status may be useful to practitioners and stakeholders working in urban or rural settings.

This study has several limitations. First, walking is based on self-report and subject to recall and social-desirability biases (Sallis and Saelens, 2000). In particular, minutes spent walking may be over- or under-estimated. However, there is no plausible reason for the biases to differ among the Index categories. Furthermore, patterns for weekly walking minutes were similar to walking prevalence. Survey response rates could contribute to response bias if there was a systematic difference between responders and nonresponders. However, NHIS data are weighted to adjust for nonresponse. Next, there were significant differences between participants included and excluded from analyses. However, distribution differences between the included sample and overall for each subgroup were < 1% and with imputed missing data, there was minimal to no change in the odds ratio estimates and no change in significance across both walking domains in the overall sample. Third, this study may have missed other factors (e.g., safety, security, comfort, car ownership) related to walking (Doyle et al., 2006; Pate et al., 2018). For example, crime is a complex mix of perception and prevalence and high-quality free national data were not available. Fourth, it may be inaccurate to assume the block group is the area most associated with a person's walking behavior (Berrigan et al., 2015). For example, a study using GPS data indicated many people spend much of their waking time in different Census geographies (Zenk et al., 2011); social characteristics of these areas differ from the home census tract (Jones and Pebley, 2014). Finally, different weighting of the components of the Index have not been explored. Future

studies examining “activity space” and residential census geographies, as well as the effect of applying different weights to the Index components, may enhance understanding of the relationship between the Index and walking behavior.

This study has several of strengths. Richness of the data and large sample size enabled multiple, stratified analyses of the Index and walking among US adults, controlling for a number of selected characteristics. In addition, by conducting the analyses at the Research Data Center, it was possible to obtain the geographic information needed to link walkability with behavioral data and to stratify the analyses by urban-rural residence. Finally, this study explores a measure of walkability which is readily available, accessible nationwide, and easily understood.

5. Conclusions

US adults living in more walkable areas report more transportation and leisure walking, especially among urban areas. Consistent with elements used in the Walkability Index, associations were stronger for transportation than for leisure walking. Findings support the use of the Walkability Index, a free, publicly available, standardized measure of walkability, by researchers, professionals, and other relevant stakeholders as a viable indicator of walkability.

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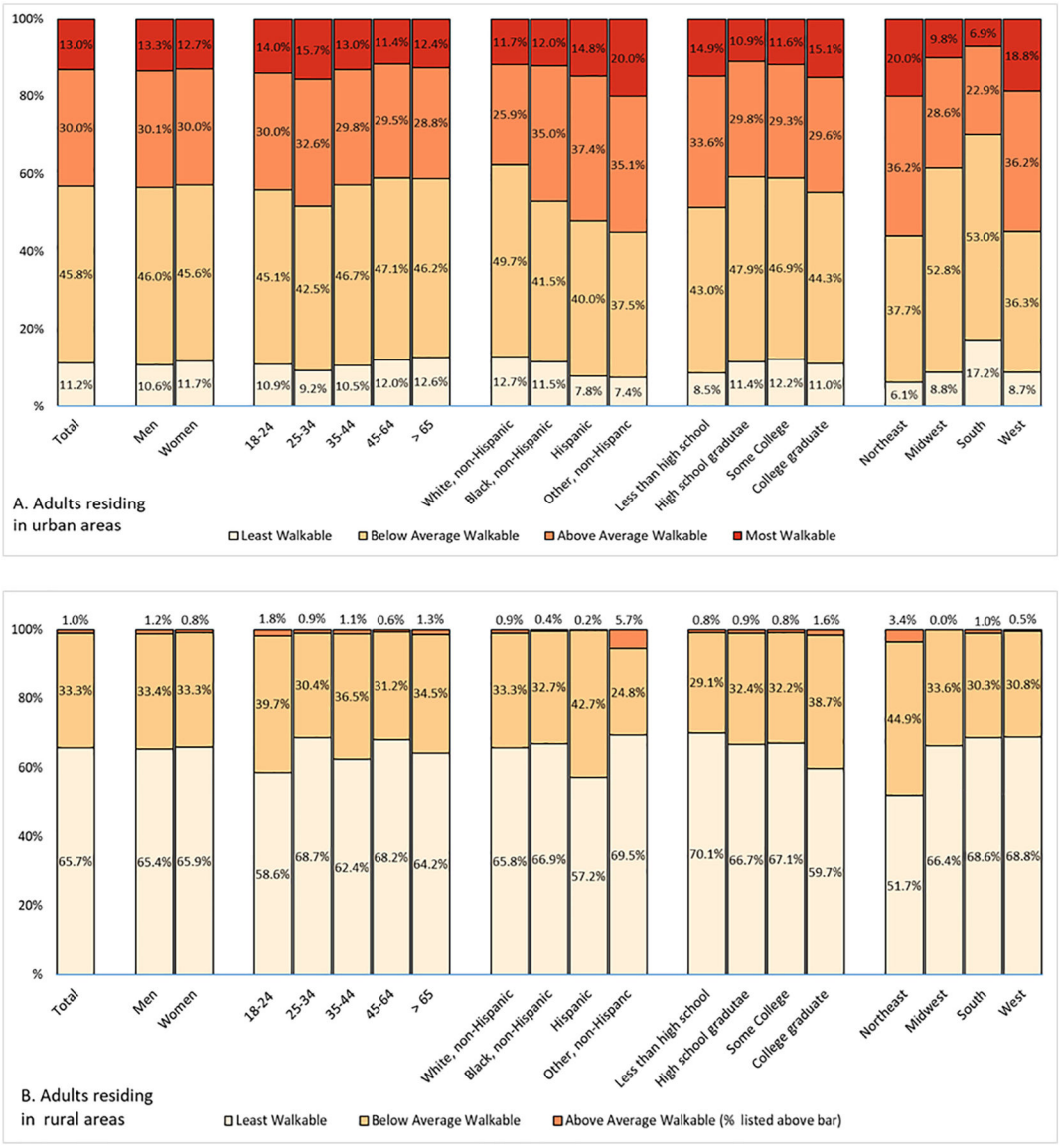

Fig. 1.

Distribution of the National Walkability Index categories among US adults by sex, age group, race/ethnicity, education level, and Census region, stratified by urban-rural residence. Note: Each characteristic was significantly associated with the Index ($p < 0.05$). Therefore, for each Index category pairwise and trend tests, where applicable, were conducted.

Table 1

Prevalence of National Walkability Index Categories by Select Characteristics, US Adults, National Health Interview Survey, 2015.

Selected characteristics	Sample characteristics	National Walkability Index Category				*p* [a]
		Least walkable (1.00–5.25)	Below average walkable (5.26–10.50)	Above average walkable (10.51–15.75)	Most walkable (15.76–20.00)	
	% (SE)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	
Total	100.0 (n/a)	20.7 (19.6, 21.8)	43.6 (42.0, 45.2)	25.0 (23.7, 26.2)	10.8 (9.9, 11.7)	
Sex						0.02
Male	48.7 (0.4)	19.7 (18.5, 21.0)	43.9 (42.1, 45.8)	25.3 (23.8, 26.8)	11.1 (10.1, 12.3)	
Female	51.3 (0.4)	21.6 (20.4, 23.0)	43.3 (41.6, 45.1)	24.7 (23.3, 26.1)	10.4 (9.5, 11.3)	
Age group (y)						< 0.001
18–24	12.8 (0.4)	16.5 (14.4, 18.9)	44.4 (41.2, 47.7)	26.6 (23.6, 29.9)	12.4 (10.4, 14.8)	
25–34	17.9 (0.3)	17.6 (15.8, 19.5)	40.9 (38.4, 43.4)	28.1 (26.0, 30.3)	13.5 (11.8, 15.3)	
35–44	16.7 (0.3)	18.4 (16.6, 20.3)	45.1 (42.7, 47.6)	25.4 (23.5, 27.4)	11.1 (9.9, 12.4)	
45–64	34.2 (0.4)	23.3 (21.8, 24.8)	43.9 (41.9, 46.0)	23.7 (22.1, 25.2)	9.1 (8.1, 10.2)	
≥65	18.4 (0.3)	23.9 (22.0, 25.9)	43.7 (41.4, 46.0)	22.8 (21.0, 24.7)	9.7 (8.5, 11.0)	
Race/ethnicity						< 0.001
White, non-Hispanic	64.7 (0.5)	25.3 (23.8, 26.9)	45.8 (43.8, 47.8)	20.0 (18.6, 21.4)	8.9 (7.9, 10.0)	
Black, non-Hispanic	11.6 (0.3)	16.0 (14.0, 18.2)	40.7 (37.8, 43.6)	32.3 (29.6, 35.2)	11.0 (9.3, 12.9)	
Hispanic	16.1 (0.4)	9.8 (8.4, 11.5)	40.2 (37.6, 42.7)	35.8 (33.1, 38.6)	14.2 (12.5, 16.1)	
Other, non-Hispanic	7.6 (0.2)	11.6 (9.6, 14.1)	36.6 (33.3, 40.0)	33.1 (29.9, 36.5)	18.7 (15.9, 21.8)	
Education level						< 0.001
Less than high school	12.1 (0.3)	19.9 (17.8, 22.1)	40.4 (37.5, 43.3)	27.6 (25.1, 30.2)	12.2 (10.5, 14.1)	
High school graduate	24.4 (0.4)	23.6 (21.9, 25.5)	44.5 (42.4, 46.6)	23.4 (21.8, 25.2)	8.5 (7.4, 9.6)	
Some college	31.2 (0.4)	22.5 (20.9, 24.3)	44.2 (42.1, 46.3)	23.9 (22.2, 25.7)	9.4 (8.4, 10.6)	
College graduate	32.3 (0.5)	17.0 (15.6, 18.4)	43.6 (41.3, 45.9)	26.2 (24.4, 27.9)	13.2 (11.7, 14.9)	
Census region [b]						< 0.001
Northeast	17.7 (0.4)	12.2 (10.2, 14.6)	38.7 (34.7, 42.9)	31.8 (28.8, 34.9)	17.3 (14.8, 20.2)	
Midwest	22.3 (0.5)	22.1 (19.4, 25.0)	48.4 (44.6, 52.2)	22.0 (19.4, 24.8)	7.5 (5.9, 9.6)	
South	36.5 (0.5)	28.4 (26.5, 30.4)	48.1 (45.5, 50.6)	18.1 (16.3, 20.1)	5.4 (4.2, 6.8)	
West	23.6 (0.4)	13.8 (12.0, 15.7)	35.8 (32.7, 39.1)	33.2 (30.3, 36.2)	17.2 (15.4, 19.2)	

Selected characteristics	Sample characteristics	National Walkability Index Category				*p* [a]
		Least walkable (1.00–5.25)	Below average walkable (5.26–10.50)	Above average walkable (10.51–15.75)	Most walkable (15.76–20.00)	
	% (SE)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	
Residence						< 0.001
Urban	82.6 (0.6)	11.2 (10.2, 12.1)	45.8 (44.0, 47.5)	30.0 (28.6, 31.6)	13.0 (12.0, 14.2)	
Rural	17.4 (0.6)	65.7 (61.8, 69.3)	33.3 (29.8, 37.1)	1.0 (0.4, 2.2)	0.0 (N/A)	

Abbreviations: N/A (not applicable).

[a]P was calculated using the chi-square test for association; pairwise and trend tests were performed for each Walkability Index category where applicable.

[b]Northeast: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, New Jersey, New York, Pennsylvania, and Vermont; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Mississippi, Maryland, North Carolina, Oklahoma, South Carolina, Virginia, Tennessee, Texas, West Virginia, and District of Columbia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Prev Med. Author manuscript; available in PMC 2021 October 25.

Table 2

Prevalence and adjusted odds ratios of reported walking for transportation and leisure by National Walkability Index Categories.

Walking domain National Walkability Index Category	Overall sample[a]		Residence			
			Urban[a,b]		Rural	
	Prevalence	Adjusted[c]	Prevalence	Adjusted[c]	Prevalence	Adjusted[c]
	% (95% CI)	OR (95% CI)	% (95% CI)	OR (95% CI)	% (95% CI)	OR (95% CI)
Transportation						
Least walkable (1.00–5.75)	21.6 (20.0, 23.2)	Reference	24.1 (21.8, 26.6)	Reference	19.5 (17.6, 21.6)	Reference
Below average walkable (5.76–10.50)	27.5 (26.2, 28.9)	1.18 (1.05, 1.33)	28.2 (26.8, 29.6)	1.20 (1.04, 1.39)	22.8 (19.5, 26.6)	1.17 (0.91, 1.51)
Above average walkable (10.51–15.25)	40.0 (38.3, 41.8)	1.92 (1.66, 2.22)	40.0 (38.3, 41.8)	1.94 (1.66, 2.28)	~	~
Most walkable (15.26–20.00)	51.6 (48.7, 54.4)	2.88 (2.43, 3.41)	51.6 (48.7, 54.4)	2.91 (2.43, 3.49)	N/A	N/A
Leisure						
Least walkable (1.00–5.75)	48.4 (46.1, 50.6)	Reference	50.7 (47.7, 53.7)	Reference	46.7 (43.7, 49.6)	Reference
Below average walkable (5.76–10.50)	52.5 (51.0, 53.9)	1.13 (1.01, 1.27)	52.6 (51.1, 54.1)	1.10 (0.96, 1.27)	51.6 (47.6, 55.6)	1.14 (0.94, 1.40)
Above average walkable (10.51–15.25)	52.5 (50.8, 54.3)	1.12 (1.00, 1.27)	52.5 (50.8, 54.3)	1.11 (0.97, 1.27)	~	~
Most walkable (15.26–20.00)	56.5 (53.9, 59.0)	1.25 (1.08, 1.45)	56.5 (53.9, 59.0)	1.25 (1.06, 1.47)	N/A	N/A

~Included in model but suppressed because of the sample size of denominator < 250 or relative standard error > 30%; the adjusted odds ratios are not significantly different than the referent groups.

N/A: No adults residing in rural areas lived among the most walkable communities.

[a] Significant ($P < 0.05$) linear trend in the National Walkability Index for transportation and leisure walking among adults in the overall sample and in urban areas.

[b] Significant ($P < 0.05$) quadratic trend in the National Walkability Index for transportation walking among adults in urban areas.

[c] All models adjusted for sex, age group, race/ethnicity, education level, and Census region.

Table 3

Geometric mean minutes and adjusted ratios[1] of reported walking for transportation and leisure among walkers by National Walkability Index Categories.

Walking domain National Walkability Index Categories	Overall sample[a]		Residence			
			Urban[a,b]		Rural	
	Mean minutes	Adjusted[c]	Mean minutes	Adjusted[c]	Mean minutes	Adjusted[c]
	M (95% CI)	Ratio[d] (95% CI)	M (95% CI)	Ratio[d] (95% CI)	M (95% CI)	Ratio[d] (95% CI)
Transportation						
Least walkable (1.00–5.75)	54.7 (51.0, 58.8)	Reference	53.6 (48.4, 59.4)	Reference	56.3 (50.8, 62.3)	Reference
Below average walkable (5.76–10.50)	55.1 (52.5, 57.8)	1.00 (0.91, 1.09)	55.7 (52.9, 58.6)	1.03 (0.92, 1.16)	51.0 (44.5, 58.5)	0.91 (0.78, 1.06)
Above average walkable (10.51–15.25)	61.2 (57.7, 65.0)	1.09 (0.98, 1.20)	61.1 (57.6, 64.9)	1.10 (0.98, 1.25)	~	~
Most walkable (15.26–20.00)	70.5 (66.1, 75.3)	1.26 (1.13, 1.40)	70.5 (66.1, 75.3)	1.28 (1.12, 1.46)	N/A	N/A
Leisure						
Least walkable (1.00–5.75)	79.2 (74.9, 83.6)	Reference	77.8 (72.8, 83.1)	Reference	80.4 (73.9, 87.5)	Reference
Below average walkable (5.76–10.50)	78.9 (76.4, 81.5)	1.00 (0.94, 1.01)	78.9 (76.2, 81.8)	1.02 (0.95, 1.07)	79.0 (72.3, 86.3)	0.97 (0.86, 0.91)
Above average walkable (10.51–15.25)	79.2 (76.1, 82.3)	1.01 (0.95, 1.04)	79.1 (76.0, 82.3)	1.03 (0.96, 1.10)	~	~
Most walkable (15.26–20.00)	86.2 (81.1, 91.7)	1.10 (1.01, 1.31)	86.2 (81.1, 91.7)	1.11 (1.02, 1.38)	N/A	N/A

~Included in model but suppressed because of the sample size of denominator < 250 or relative standard error > 30%; the adjusted ratios are not significantly different than the referent groups.

N/A: No adults residing in rural areas lived in the most walkable communities.

[a]Significant ($P < 0.05$) linear trend in the National Walkability Index for transportation and leisure walking among adults in the overall sample and in urban areas.

[b]Significant ($P < 0.05$) quadratic trend in the National Walkability Index for transportation walking among adults in urban areas.

[c]All models adjusted for sex, age group, race/ethnicity, education level, and US Census region.

[d]The adjusted ratio is the exponentiated beta coefficient and represents the ratio of the geometric weekly minutes of the group of interest to the referent group. It also represents the mean difference in the log-transformed minutes of walking.