Walking to Public Transit
Steps to Help Meet Physical Activity Recommendations

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Background: Nearly half of Americans do not meet the Surgeon General's recommendation of ≥30 minutes of physical activity daily. Some transit users may achieve 30 minutes of physical activity daily solely by walking to and from transit. This study estimates the total daily time spent walking to and from transit and the predictors of achieving 30 minutes of physical activity daily by doing so.

Methods: Transit-associated walking times for 3312 transit users were examined among the 105,942 adult respondents to the 2001 National Household Travel Survey, a telephone-based survey sponsored by the U.S. Department of Transportation to assess American travel behavior.

Results: Americans who use transit spend a median of 19 minutes daily walking to and from transit; 29% achieve ≥30 minutes of physical activity a day solely by walking to and from transit. In multivariate analysis, rail users, minorities, people in households earning <$15,000 a year, and people in high-density urban areas were more likely to spend ≥30 minutes walking to and from transit daily.

Conclusions: Walking to and from public transportation can help physically inactive populations, especially low-income and minority groups, attain the recommended level of daily physical activity. Increased access to public transit may help promote and maintain active lifestyles. Results from this study may contribute to health impact assessment studies (HIA) that evaluate the impact of proposed public transit systems on physical activity levels, and thereby may influence choices made by transportation planners.
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Introduction

The Surgeon General recommends that adults participate in ≥30 minutes of physical activity daily. However, nearly half of American adults do not meet the guidelines.[1,2] The impact of the built environment on obesity and physical activity is a relatively new field of research. Features of the built environment, such public parks and accessible gyms, can play a role in increasing physical activity among Americans.[3] Increased access to public transportation could also provide more opportunities for physical activity because most transit trips begin and/or end with walking. The purpose of this study was to estimate the daily level of physical activity obtained by Americans solely by walking to and from transit, and to examine the associations of these physical activity levels with age, education, race/ethnicity, gender, income, transit type, population density, and car ownership.

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The Surgeon General advises that to be beneficial, physical activity can be continuous or intermittent, should be moderately or vigorously intense, and can be acquired through leisure-time exercise or through everyday activities such as cleaning the house.[1,4] Under these recommendations, moderate or vigorous physical activity can be acquired in shorter bouts and still contribute to the recommended 30 minutes a day. In 2003, only 52.8% of Americans achieved 30 minutes of moderately vigorous activity at least 5 days a week (Centers for Disease Control and Prevention recommendation), and approximately 23% of Americans had no leisure-time physical activity within the past month.[5] Some of these physically inactive individuals may have obtained physical activity through non-leisure activities. Because physical inactivity is associated with obesity, premature mortality, and other chronic diseases, a *Healthy People 2010* objective aims to decrease the prevalence of no leisure-time physical activity among Americans.[6]

Research suggests that the built environment influences physical activity participation, including recreational walking and walking to and from transit.[7–18] A study by Cervero and Radisch[19] compared two San Francisco Bay area communities with similar income levels and transportation services but different commu-

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nity designs. The Rockridge community features compact development and mixed land uses that encourage walking and biking, while the Lafayette community has large-lot tract housing, automobile-oriented developments, and poorly connected streets that are not conducive to walking and biking. Rockridge residents had higher rates of walking or bicycling trips to and from transit and were approximately 5 times more likely to walk or bike to a nonwork destination than Lafayette residents. This study also provided evidence that Rockridge residents were more likely than Lafayette residents to substitute walking or bicycling for automobile trips.

Methods

The 2001 National Household Travel Survey (NHTS) was used to determine the physical activity that Americans obtain solely by walking to and from public transit. The NHTS is a U.S. Department of Transportation telephone-based survey that collects travel-related information about the civilian, noninstitutionalized U.S. population.[20] Households from all 50 states and the District of Columbia were interviewed along with households in nine regions for smaller-scale analyses (Baltimore, Des Moines, Lancaster PA, Kentucky, New York, Texas, Wisconsin, Hawaii, and the island of Oahu).

Sample Selection

Random-digit dialing was used to ensure an equal probability of sampling among households with telephones. The sampling frame was all telephone numbers in 100 banks of numbers (same first eight digits) that had at least one residential number listed. A systematic sample was taken from the list of telephone numbers after it was sorted by a number of geographic variables.

Interviews

When addresses were available, households were first contacted with an introductory letter and an incentive. One week after the mailing, households were called to obtain household-level demographics. Except in emancipated households, people aged ≥18 years were required to complete the household interviews. Households were assigned a 24-hour travel day in which members were to record travel-related information such as trip times, purposes, and modes (in the provided diary). After the assigned travel day, interviewers attempted to contact each household member to collect individual-level demographics, employment information, and travel-day details. Interviewers obtained information about all trips, including trips to school or work, to attend social events, to visit friends or family, to transport someone, to visit the doctor or dentist, and trips to and from public transportation.

The Sample

Households were included in the final data set if ≥50% of the household adults completed an interview ("useable" household). For the full sample data set (including the nine add-on areas), 32.2% of households completed an interview and were "useable," and 91.4% of individuals in useable households completed an interview (29.4% overall person response rate among useable households). This resulted in 69,817 useable households, 105,942 adults, and 54,816 children.

Study exclusions. Children aged <18 years were excluded, and only people who walked to and from transit during their assigned travel day were included in the analysis. Because of the NHTS data set limitations, walking trips to and from public transit were excluded if they included a mode other than walking. For example, a walking trip was excluded if someone drove to a parking lot and then walked to transit. Improbable walking trip lengths (>60 minutes) were also excluded, resulting in the elimination of 0.53% of all walking trips to transit and 3.79% of all walking trips from transit. After restrictions were made, the final sample size was 3312 individuals.

Weights

The NHTS data set included weights that were used to reduce nonresponse and selection bias for the national sample and the nine add-on regions. To adjust for these biases, weights were based on household characteristics ascertained during incomplete interviews, demographic data available on households not administered the survey, and independent demographic controls provided by 2000 Census data.[21] Weights were also adjusted for multiple telephone lines in a household and for differences in travel by season and day of week.

Analyses

Descriptive statistics were calculated in 2005 for the entire NHTS sample and for the sample that walked to and from transit (Table 1). For the sample walking to and from transit, all walking trip times to and from transit for 1 day were added together to calculate the total transit-related walking time for each individual. The weighted mean, and 25th, 50th, and 75th percentiles were calculated for total walking time to and from transit and were stratified by age, education, race/ethnicity, household income, transit type, population density, and car ownership.

Bivariate and multivariate analyses were performed to determine the predictors of achieving at least 30 minutes of daily physical activity solely by walking to and from transit. The crude and adjusted odds ratios (ORs), 95% confidence intervals (CIs), and Wald chi-square p values were calculated using weights. SAS, version 9.0 (SAS Institute Inc., Cary NC, 2002) and SUDAAN, version 9.0 (Research Triangle Institute, Research Triangle Park NC, 2004) were used to calculate the weighted estimates. Only SUDAAN was also used to calculate variance-based statistics.

Results

From the NHTS sample, 3.1% of adults (3312 out of 105,942) walked to and from transit during their assigned travel day, with a mean total walking time of 24.3 minutes and a median time of 19.0 minutes (Table 2 and Figure 1). The median single walking trip time to or from transit was 4.0 minutes, and the sample walked a total of 11,940 separate segments to or from transit.

Table 1. Demographic comparison of full sample and people who walk to and from transit, 2001 National Household Travel Survey

	Transit walkers (n=3312)			Full Sample (n = 105,942)		
Variable	n[a]	**Weighted %**	**95% CI**	n[a]	**Weighted %**	**95% CI**
Transit Type[b]						
Bus	1914	59.8	56.9–62.6	2150	60.2	57.6–62.8
Rail	1153	40.2	37.4–43.1	1249	39.8	37.2–42.4
Household income						
<$15,000	683	23.4	20.7–26.2	7102	8.9	8.5–9.3
$15,000–34,999	792	25.0	22.2–28.1	21047	22.8	22.2–23.4
$35,000–69,999	769	25.1	22.8–27.6	39456	37.5	36.7–38.2
≥$70,000	806	26.5	23.8–29.4	30859	30.8	30.1–31.5
Age (years)						
18–29	781	34.1	31.7–36.6	15204	21.9	21.5–22.4
30–39	710	25.5	23.0–28.2	20228	22.3	21.8–22.8
40–49	698	17.0	14.6–19.7	24095	21.3	20.9–21.6
≥50	1123	23.4	21.2–25.6	46415	34.5	34.1–34.8
Education						
<High school degree	481	17.1	15.2–19.1	8408	10.4	10.1–10.8
High school degree	837	26.3	23.9–28.7	34172	31.0	30.4–31.5
Undergraduate[c]	1374	41.5	38.9–44.1	48438	46.3	45.7–46.8
Graduate[c]	589	15.2	13.3–17.3	14534	12.4	12.0–12.7
Race/ethnicity						
White	1601	38.2	35.6–40.8	89204	73.1	72.7–73.5
African American	803	30.1	27.5–32.8	4776	11.1	10.8–11.3
Asian/Pacific Islander	285	6.4	5.0–8.1	4082	2.7	2.5–3.0
Hispanic	272	14.7	12.6–17.1	2665	6.1	5.8–6.4
Other[d]	306	10.6	9.0–12.5	4502	7.0	6.6–7.4
Gender						
Male	1407	44.7	42.3–47.0	50459	49.2	49.0–49.4
Female	1905	55.3	53.0–57.7	55483	50.8	50.6–51.0
Population density[e]						
<4000	680	17.0	14.7–19.5	74080	63.4	62.7–64.1
4000–9999	667	20.8	18.4–23.4	22045	23.9	23.3–24.5
10,000–24,999	722	23.3	20.8–26.0	6262	8.5	8.1–8.9
≥25,000	1243	38.9	36.1–41.8	3519	4.2	4.0–4.4
Household owned car						
Primary driver	920	25.2	22.6–28.0	86909	79.4	78.9–79.8
Not primary driver	1065	33.8	31.0–36.7	13182	13.4	12.9–13.8
No car	1327	41.0	38.2–43.9	5851	7.3	7.0–7.5

[a]Unweighted sample size.
[b]Boat category was eliminated for this analysis because of small numbers.
[c]Completed courses or obtained degree in specified level of education.
[d]Native Americans, Alaskan natives, and mixed races/ethnicities (white and African American, white and Asian).
[e]People per gross square mile, based on census block groups (data source: Claritas).
CI, confidence interval.

Trip purposes included 38.9% for commuting to work, 14.4% for shopping, 11.4% for family or personal business, 9.0% for school or church activities, 9.0% for social or recreational activities, 5.9% to visit friends, 5.0% to visit a doctor or dentist, 3.3% for work-related trips, and 2.4% for other miscellaneous trips.

When the weighted frequencies for the entire NHTS population were compared to the weighted frequencies for the population walking to and from transit, there were significant differences by most variables, including age, income, education, race/ethnicity, gender, and car ownership (Table 1). In particular, there were significantly more individuals in households earning <$15,000 among those walking to and from transit, significantly more of the youngest age group among the transit walkers, and significantly more of the oldest age group among the full sample. Among the walkers to and from transit, there were significantly more of the least educated group, fewer whites and more minorities, more females, more individuals living in a population density of ≥25,000 persons per square mile, and more people living in households without a car.

Considerable differences were observed between mean total walking times by income, education, race/ethnicity, gender, population density, and car ownership, but not by age and transit type (Table 2). When stratified by income, the highest mean total walking time was 29.0 minutes for people in households earning <$15,000 a year, and the lowest mean time was 20.5 minutes for people in households earning ≥$70,000 a

Table 2. Mean and median total walk times to and from transit and percent who walked ≥30 minutes to and from transit per day, 2001 National Household Travel Survey

Variable	Mean walk time (SE)	*t*-test *p* value[a]	Percentiles			% walked ≥30 minutes (SE)
			Median			
			25%	50%	75%	
Transit type						
Bus	23.7 (1.01)	Ref.	9.0	17.0	30.0	28.5 (1.98)
Rail	23.9 (0.82)	0.892	10.0	20.0	30.0	28.1 (1.69)
Household income						
<$15,000	29.0 (1.35)	**<0.001*****	12.0	22.0	40.0	40.3 (2.99)
$15,000–34,999	25.5 (1.87)	**0.019***	12.0	20.0	33.0	31.0 (3.10)
$35,000–69,999	22.5 (1.03)	0.167	10.0	18.0	30.0	27.5 (2.59)
≥$70,000	20.5 (1.05)	Ref.	8.0	16.0	25.0	20.4 (2.04)
Age (years)						
18–29	24.0 (1.39)	Ref.	10.0	19.0	31.0	28.9 (2.19)
30–39	23.1 (0.93)	0.585	10.0	19.0	30.0	25.8 (2.53)
40–49	24.8 (1.22)	0.619	10.0	20.0	33.0	31.5 (2.77)
≥50	25.6 (1.46)	0.421	10.0	20.0	33.0	31.7 (2.72)
Education						
<High school degree	29.3 (1.70)	**<0.001*****	14.0	22.0	38.0	40.7 (3.75)
High school degree	24.8 (0.95)	**0.003****	12.0	20.0	30.0	29.3 (2.45)
Undergraduate[b]	23.0 (1.22)	0.144	8.0	18.0	30.0	25.8 (2.08)
Graduate[b]	20.6 (1.06)	Ref.	10.0	15.0	29.0	24.8 (3.03)
Race/ethnicity						
White	19.4 (0.75)	Ref.	8.0	15.0	25.0	18.2 (1.56)
African American	25.6 (0.89)	**<0.001*****	11.0	20.0	33.0	32.8 (2.15)
Asian/Pacific Islander	27.4 (2.12)	**0.001****	11.0	24.0	40.0	41.1 (5.66)
Hispanic	29.2 (1.71)	**<0.001*****	15.0	21.0	38.0	39.5 (4.00)
Other[c]	29.7 (3.63)	**0.006****	10.0	20.0	37.0	39.5 (4.80)
Gender						
Male	22.7 (0.61)	Ref.	10.0	20.0	30.0	26.9 (1.67)
Female	25.6 (1.05)	**0.016***	10.0	19.0	33.0	31.1 (1.78)
Population density[d]						
<4000	18.8 (1.56)	Ref.	5.0	10.0	25.0	18.9 (3.04)
4000–9999	24.4 (2.03)	**0.018***	10.0	18.0	30.0	27.7 (2.64)
10,000–24,999	24.5 (1.22)	**0.006****	10.0	18.0	32.0	29.1 (2.75)
≥25,000	26.4 (0.81)	**<0.0001*****	13.0	22.0	35.0	34.6 (2.31)
Household owned car						
Primary driver	19.7 (1.00)	Ref.	7.0	15.0	25.0	19.8 (2.17)
Not primary driver	23.0 (1.33)	**0.048***	10.0	18.0	30.0	26.1 (2.03)
No car	28.1 (0.91)	**<0.001*****	13.0	22.0	37.0	37.6 (2.28)
Total	24.3 (0.66)	—	10.0	19.0	31.0	29.2 (1.27)

[a]Testing difference between means in each categorical variable using *t*-test (between single category level and referent category level).
[b]Completed courses or obtained degree in specified level of education.
[c]Native Americans, Alaskan natives, and mixed races/ethnicities (white and African American, white and Asian, etc.).
[d]People per gross square mile, based on census block groups (data source: Claritas).
**p*<0.05 (bolded);
***p*<0.01 (bolded);
****p*<0.001 (bolded).
Ref., referent; SE, standard error.

year. Compared to people with a graduate-level education (20.6 minutes), people without a high school degree (29.3 minutes), and people who completed high school (24.8 minutes) had significantly higher mean total walking times to and from transit, while people with undergraduate-level education (23.0 minutes) did not have a significantly different mean total walking time. Hispanics (29.2 minutes) and people of other race/ethnicities (29.7 minutes) had the longest mean total walking times, whereas whites had the shortest (19.4 minutes). Compared with men, women had a 2.9-minute greater mean total walking time to and from transit. People living in an area with a population of 4000 to 9999, 10,000 to 24,999, or ≥25,000 per square mile had significantly higher mean total walking times (24.4, 24.5, and 26.4 minutes, respectively) compared with people living in an area with <4000 people per square mile (18.8 minutes). People who were not primary drivers of a household vehicle (23.0 minutes) or who lived in a household without a car (28.1 minutes) had a significantly higher mean total walk time than primary drivers (19.7 min-

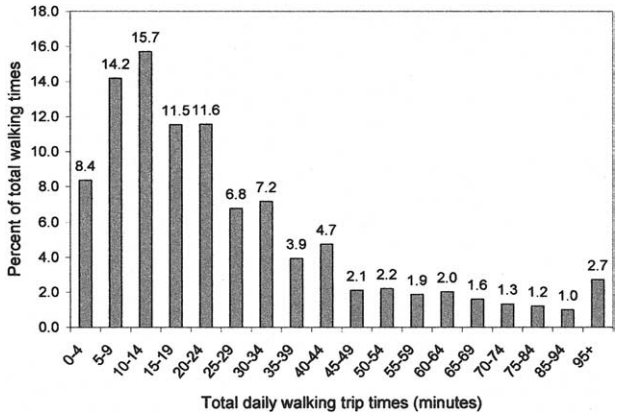

Figure 1. Total daily walking trip times to and from transit (n =3312), 2001 National Household Travel Survey.

utes). Similar differences were observed among the various categories when median walking times were compared, but the median walking times were lower than the mean walking times in all instances.

Bivariate analysis revealed a significant difference in total walking times by income, education, race/ethnicity, population density, and car ownership (Table 3). When compared with people in households earning ≥$70,000 per year, people in households earning <$15,000 (OR=2.63, 95% CI=1.83–3.77), $15,000–$34,999 (OR=1.75, 95% CI=1.17–2.62), and $35,000–$69,999 (OR=1.48, 95% CI=1.04–2.11) were significantly more likely to have walked ≥30 minutes to and from transit. People who did not complete high school were significantly more likely than people with a graduate level education to walk ≥30 minutes to and from transit (OR=2.08, 95% CI=1.37–3.15). When compared with whites, African Americans (OR=2.20, 95% CI=1.65–2.93), Asians/Pacific Islanders (OR=3.13, 95% CI=1.93–5.10), Hispanics (OR=2.93, 95% CI=1.94–4.40), and people of other race/ethnicities (OR=2.93, 95% CI=1.85–4.66) were significantly more likely to have walked ≥30 minutes to and from transit. Individuals living in regions with ≥25,000 people per square mile were significantly more likely to walk ≥30 minutes to and from transit compared with people living in regions with <4000 per square mile (OR=1.52, 95% CI=1.17–1.99). When compared to individuals who were primary drivers of a household car, individuals who lived in a household without a car were significantly more likely to walk ≥30 minutes to or from transit (OR=1.97, 95% CI=1.52–2.55).

In multivariate analysis, transit type, income, race/ethnicity, and car ownership were significantly associated with walking ≥30 minutes to and from transit (Table 3). People who walked ≥30 minutes to and from transit were 1.67 times more likely to use rail than bus (95% CI=1.21–2.32). When compared to the highest income group, only the lowest income group was associated with walking ≥30 minutes to and from transit (OR=2.01, 95% CI=1.24–3.28). People walking ≥30 minutes to and from transit were significantly more likely to be African American, Hispanic, Asian/Pacific Islander, or from another race/ethnic category than to be white, and were somewhat (borderline significant association) more likely to live in an area with 4000 to 9999 people per square mile than in an area with <4000 people per square mile (OR=1.63, 95% CI=0.99–2.68). Compared to primary drivers of a household vehicle, individuals living in a household with no car were significantly more likely to walk ≥30 minutes to and from transit (OR=1.66, 95% CI=1.07–2.56).

Discussion

Results from this study suggest that Americans who walk to and from public transit obtain an appreciable amount of daily transit-related physical activity (median of 19 minutes). This study also suggests that 29% of transit walkers achieve ≥30 minutes of daily physical activity solely by walking to and from transit. Efforts to increase transit accessibility and usage may not only decrease road congestion and air pollution but may have the added health benefit of increasing the proportion of Americans who obtain ≥30 minutes of daily physical activity.

People of lower socioeconomic status (SES) obtained the greatest amount of physical activity by walking to and from transit, while it is this same population that experiences some of the highest levels of obesity.[22] Reasons for more walking among low-income populations could be that they are more likely to live in urban areas with better access to transit or are less likely to own a personal automobile. The Transportation Research Board has reported that people living in households earning <$20,000 a year are more likely to use transit than other income groups.[23] Although an association between lower income and decreased car ownership has been found in previous studies, the relation is not always straightforward.[24,25] Cities like Toronto, with wealth levels comparable to U.S. cities, have planning that favors nonautomotive modes of transportation, and their residents use transit at much higher levels.[25] Even though low-income groups obtain higher walk times to and from transit, many other factors influence obesity rates in these populations.

Minority groups demonstrated higher walking times to and from transit than whites, but like low-income groups, minorities tend to have the highest obesity rates.[22] The association between race/ethnicity and total walking time remained after controlling for income, which suggests that race/ethnicity alone may be a predictor of walking to and from transit. Previous reports indicate that African Americans, Hispanics, and Asians are more likely to use transit than are whites.[23] Like low-income individuals, minorities may live more

Table 3. Characteristics associated with walking to and from transit ≥30 minutes a day in bivariate and multivariate analysis, 2001 National Household Travel Survey

	Bivariate analysis[a]		Multivariate analysis[b]	
Variable	**Odds ratio (95% CI)**	***p* value**	**Odds ratio (95% CI)**	***p* value**
Transit type				
Bus	Ref.	Ref.	Ref.	Ref.
Rail	1.02 (0.79–1.32)	0.889	1.67 (1.21–2.32)	**0.002****
Household income				
<$15,000	2.63 (1.83–3.77)	**<0.001*****	2.01 (1.24–3.28)	**0.004****
$15,000–34,999	1.75 (1.17–2.62)	**0.009****	1.34 (0.85–2.12)	0.208
$35,000–69,999	1.48 (1.04–2.11)	**0.030***	1.26 (0.83–1.94)	0.273
≥$70,000	Ref.	Ref.	Ref.	Ref.
Age (years)				
18–29	Ref.	Ref.	Ref.	Ref.
30–39	0.85 (0.61–1.18)	0.329	0.93 (0.64–1.35)	0.693
40–49	1.13 (0.81–1.58)	0.468	0.76 (0.50–1.16)	0.202
≥50	1.14 (0.84–1.56)	0.401	1.06 (0.66–1.71)	0.803
Education				
<High school degree	2.08 (1.37–3.15)	**0.001****	1.03 (0.58–1.83)	0.913
High school degree	1.26 (0.86–1.85)	0.233	0.76 (0.44–1.30)	0.304
Undergraduate[c]	1.05 (0.71–1.55)	0.797	0.75 (0.50–1.15)	0.181
Graduate[c]	Ref.	Ref.	Ref.	Ref.
Race/ethnicity				
White	Ref.	Ref.	Ref.	Ref.
African American	2.20 (1.65–2.93)	**<0.001*****	1.69 (1.17–2.44)	**0.005****
Asian/Pacific Islander	3.13 (1.93–5.10)	**<0.001*****	2.52 (1.45–4.40)	**0.001****
Hispanic	2.93 (1.95–4.40)	**<0.001*****	1.88 (1.18–2.99)	**0.007****
Other[d]	2.93 (1.85–4.66)	**<0.001*****	2.01 (1.20–3.38)	**0.007****
Gender				
Male	Ref.	Ref.	Ref.	Ref.
Female	1.23 (0.98–1.55)	0.075	1.21 (0.91–1.61)	0.174
Population density[e]				
<4000	Ref.	Ref.	Ref.	Ref.
4000–9999	0.91 (0.67–1.23)	0.539	1.63 (0.99–2.68)	0.053
10,000–24,999	0.99 (0.72–1.38)	0.969	1.26 (0.72–2.20)	0.412
≥25,000	1.52 (1.17–1.99)	**0.003****	1.58 (0.97–2.55)	0.061
Household owned car				
Primary driver	Ref.	Ref.	Ref.	Ref.
Not primary driver	0.79 (0.62–1.02)	0.063	1.13 (0.77–1.66)	0.534
No car	1.97 (1.52–2.55)	**<0.001*****	1.66 (1.07–2.56)	**0.022***

*$p<0.05$ (bolded);
**$p<0.01$ (bolded);
***$p<0.001$ (bolded).
[a]Crude association between each single characteristic and total daily walk time of ≥30 minutes to and from transit.
[b]Adjusted association between variable and total daily walk time of ≥30 minutes to and from transit, controlling for all other variables simultaneously (n = 2926). (SUDAAN R^2 statistic = 0.0747).
[c]Completed courses or obtained degree in specified level of education.
[d]Native Americans, Alaskan Natives, and mixed races/ethnicities (white and African American, white and Asian,etc.).
[e]People per gross square mile, based on census block groups (data source: Claritas).
CI, confidence interval; Ref., referent.

often than whites in urban areas close to public transportation, resulting in more walking to and from transit than whites. Similar to low-income groups, walking to and from transit is just one of many predictors of obesity among minority groups.

In multivariate analysis, transit type also significantly predicted walking ≥30 minutes to and from transit. Rail users were more likely than bus users to walk ≥30 minutes to and from transit. It may be that people are willing to walk further or more often to rail stations than to bus stops, which could be a result of the greater demand and preference for rail than bus.[26]

Limitations

The analyses slightly underestimated the percentage of people walking to and from transit because people who walked and used other modes to and from transit were excluded. Since <5% of all walking trips to and from transit were excluded, the expected effect of these exclusions is small. The exclusion of people claiming that they walked >60 minutes one way to or from transit may have underestimated the percentage of transit walkers or the median total walk time to and from transit. Also, the percentage of low-income indi-

viduals walking to and from transit may have been underestimated since the NHTS only collects information on households with telephones.

An additional limitation of the study was the overall low response rate, which was in part a result of the rigorous requirement that ≥50% of the household adults complete person-level interviews. While the response rate is a limitation of this study, the large sample size and the weighting of the data allow the estimates to more accurately represent the U.S. population. Although the response rate may limit the generalizability of this study, the NHTS provides the best available data with which to estimate how much Americans walk to and from transit.

Approximately 72% (9641/11,940) of single-segment walking trips to and from transit were <10 minutes. The Surgeon General currently recommends that Americans obtain physical activity in periods of ≥10 minutes.[1] It seems likely that physical activity accumulated in periods of <10 minutes would have a positive health benefit compared with no activity. Evidence suggests that men who expend the same total amount of energy during a single episode of physical activity, regardless of whether it was accumulated in durations of 1 to 15 minutes or longer, do not differ in coronary heart disease risk.[27] A related limitation is the lack of data on whether the walking was at least moderately intense. Therefore, there is no way to determine whether the physical activity obtained in this study population qualifies as the Surgeon General's recommended physical activity.

Another possible limitation is the accuracy of trip recall after the travel day. To reduce this, diaries were provided for each household member and interviewers only collected data up to 6 days after the travel day. Approximately 62% of the population who walked to and from transit completed their diaries. Inaccuracy of trip reporting was most likely minimized by diary usage and strict interviewing practices.

Implications and Future Research

These results will be helpful for health impact assessment (HIA) studies that look at the impact of proposed public transportation systems on physical activity. HIA is an innovative tool that examines how projects and policies not directly related to health may impact a variety of health outcomes such as obesity, physical activity, injury, health equity, air and water quality, disabilities, mental health, and social capital.[28,29] For example, results from this report are being used to estimate the amount of transit-related walking that would result from a proposed 22-mile, urban light-rail loop in Atlanta.[30] HIA studies may influence choices made by transportation planners and other community decision makers.[31]

What This Study Adds . . .

Few studies have examined the amount of physical activity associated with use of transit.

No estimate exists on the proportion of Americans who achieve the recommended amount of daily physical activity solely by walking to and from transit.

This is the first study to examine the physical activity obtained by Americans who walk to and from transit, and the predictors of achieving ≥30 minutes of transit-related physical activity daily.

As obesity rates have increased in the United States, a multidisciplinary approach to promote physical activity has begun that includes targeting aspects of the built environment.[32] Part of the Centers for Disease Control and Prevention's physical activity recommendations includes environmental policy suggestions that encourage transportation-related physical activity.[33] This study provides some evidence that walking to and from transit can help physically inactive populations (especially minority groups and people of lower socioeconomic status) attain 30 minutes of daily physical activity. Although the exertion level of each walking trip to and from transit was unknown, the walkers in this study obtained physical activity that they may not have otherwise. Improvements to the built environment, such as increased access to public transit, may provide a viable and effective option to promote and maintain active lifestyles.

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