Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Surveillance Summaries / Vol. 64 / No. 7
August 28, 2015

Active Transportation Surveillance — United States, 1999–2012

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CONTENTS

Introduction 1
Methods 2
Results 7
Discussion 11
Limitations 16
Conclusion 16
References 17

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Title]. MMWR Surveill Summ 2015;64(No. SS-#):[inclusive page numbers].

Active Transportation Surveillance — United States, 1999–2012

Geoffrey P. Whitfield, PhD[1]
Prabasaj Paul, PhD[2]
Arthur M. Wendel, MD[1]

[1]*Office of Noncommunicable Diseases, Injury, and Environmental Health, National Center for Environmental Health, Division of Emergency and Environmental Health Services, Healthy Community Design Initiative*
[2]*Office of Noncommunicable Diseases, Injury, and Environmental Health, National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition Physical Activity and Obesity, Physical Activity and Health Branch*

Abstract

Problem/Condition: Physical activity is a health-enhancing behavior, and most U.S. adults do not meet the 2008 *Physical Activity Guidelines for Americans*. Active transportation, such as by walking or bicycling, is one way that persons can be physically active. No comprehensive, multiyear assessments of active transportation surveillance in the United States have been conducted.

Period Covered: 1999–2012.

Description of Systems: Five surveillance systems assess one or more components of active transportation. The American Community Survey and the National Household Travel Survey (NHTS) both assess the mode of transportation to work in the past week. From these systems, the proportion of respondents who reported walking or bicycling to work can be calculated. NHTS and the American Time Use Survey include 1-day assessments of trips or activities. With that information, the proportion of respondents who report any walking or bicycling for transportation can be calculated. The National Health and Nutrition Examination Survey and the National Health Interview Survey both assess recent (i.e., in the past week or past month) habitual physical activity behaviors, including those performed during active travel. From these systems, the proportion of respondents who report any recent habitual active transportation can be calculated.

Results: The prevalence of active transportation as the primary commute mode to work in the past week ranged from 2.6% to 3.4%. The 1-day assessment indicated that the prevalence of any active transportation ranged from 10.5% to 18.5%. The prevalence of any habitual active transportation ranged from 23.9% to 31.4%. No consistent trends in active transportation across time periods and surveillance systems were identified. Among systems, active transportation was usually more common among men, younger respondents, and minority racial/ethnic groups. Among education groups, the highest prevalence of active transportation was usually among the least or most educated groups, and active transportation tended to be more prevalent in densely populated, urban areas.

Interpretation: Active transportation is assessed in a wide variety of ways in multiple surveillance systems. Different assessment techniques and construct definitions result in widely discrepant estimates of active transportation; however, some consistent patterns were detected across covariates. Although each type of assessment (i.e., transportation to work, single day, and habitual behavior) measures a different active transportation component, all can be used to monitor population trends in active transportation participation.

Public Health Action: An understanding of the strengths, limitations, and lack of comparability of active transportation assessment techniques is necessary to correctly evaluate findings from the various surveillance systems. When used appropriately, these systems can be used by public health and transportation professionals to monitor population participation in active transportation and plan and evaluate interventions that influence active transportation.

Corresponding author: Geoffrey P. Whitfield, PhD, Office of Noncommunicable Diseases, Injury, and Environmental Health, National Center for Environmental Health, Division of Emergency and Environmental Health Services, CDC. Telephone: 770-488-3976; E-mail: xdh5@cdc.gov.

Introduction

Although the health-enhancing effects of regular participation in vigorous and moderate intensity physical activity are well established (*1*), approximately half of U.S. adults do not meet the aerobic physical activity guideline (*2*). Increasing

population participation in physical activity is a public health priority. CDC has identified increasing participation in physical activity as one of the public health priorities known as winnable battles (*3*). Fifteen of the *Healthy People 2020* objectives focus on physical activity (*2*).

Physical activity often is categorized into four domains based on the location or purpose of the activity: 1) leisure, 2) domestic, 3) occupational, and 4) transportation. Transportation-related physical activity can be increased through promotion of active transportation, defined as any self-propelled, human-powered mode of transportation (*4*). Three *Healthy People 2020* physical activity objectives involve active transportation: PA-13 (increase the proportion of trips made by walking); PA-14 (increase the proportion of trips made by bicycling); and PA-15.2 (increase transportation and travel policies for the built environment that enhance access to and availability of physical activity opportunities). Broad-reaching, durable, built-environment and policy interventions such as connected active transportation networks, bicycle trails, sidewalks, and complete streets policies can support active transportation and potentially increase physical activity throughout a community (*5*,*6*).

Levels of active transportation in the United States lag behind those of many other developed nations. A recent review of data on transportation to work for 16 countries revealed a high prevalence of walking or bicycling to work in the Netherlands (37.9%) and France (34.9%), whereas U.S. estimates ranged from 4.0% to 16.7% and varied by assessment method (*7*). The reasons for these differences are likely multifactorial and might include cultural norms, land use, and cost of automobile ownership. Nevertheless, such comparisons suggest that greater participation in active transportation in the United States is possible. Recent evidence from the National Household Travel Survey (NHTS) suggests that active transportation might be increasing in the United States. For example, residents completed an average of 19 more annual walk or bike trips in 2009 than in 2001 (*8*).

Considering the potentially dynamic nature and health impact of active transportation, surveillance is important for monitoring trends in participation. Although five national surveillance systems assess certain components of active transportation in the United States, this report is the first to present a comprehensive, multiyear comparison of selected estimates from these systems for 1999–2012. The findings in this report will allow public health and transportation professionals to better understand the ramifications of selecting different active transportation measures and serve as national prevalence estimates for this health behavior.

Methods

The data sources used in this report include all national surveillance systems that allow estimation of a component of active transportation: NHTS, the American Community Survey (ACS), the American Time Use Survey (ATUS), the National Health and Nutrition Examination Survey (NHANES), and the National Health Interview Survey (NHIS) (Table 1). All data were publicly available online and downloaded so that results could be applicable for all potential users, particularly transportation professionals and public health practitioners at the state and local levels. Surveillance systems were categorized by the type of active transportation construct assessed:

- Mode of transportation to work in the past week: ACS and NHTS
- Single-day trips or activities: NHTS and ATUS
- Typical active transportation behaviors: NHANES and NHIS

Assessments

Transportation to Work

ACS is an annual survey of the noninstitutionalized U.S. population that has been conducted by the U.S. Census Bureau since 2005. Initial surveys used a sample of approximately 2.9 million addresses from the census master address list. In 2011, 3.5 million addresses were used. Information is collected from all residents at an address. This review is limited to the 2005–2012 single-year data releases, which provide individual-level data for geographic areas down to the public use microdata area (PUMA) level (*9*). For each year, the prevalence of active transportation was calculated as the proportion of workers reporting walking or bicycling as the primary commute mode to work in the past week.

NHTS is a periodic survey conducted by the U.S. Department of Transportation. List-assisted, random-digit dialing is used to obtain a national sample that is weighted for national representativeness. NHTS uses trip-based travel diaries for data collection and a travel questionnaire that asks respondents how they traveled to work in the previous week. The NHTS assessment is very similar to the ACS assessment. Accordingly, the prevalence of active transportation was calculated as the proportion of workers reporting walking or bicycling as the primary commute mode to work in the past week.

Single Day

NHTS participants complete a 1-day trip log in which they record the origin, destination, mode, purpose, and travel time of all trips taken on a sampled day. Respondents include employed and unemployed persons, resulting in a larger sample size than the NHTS sample for transportation to work. Trips reported with a travel mode of walk or bicycle and a reported purpose other than "to go to the gym/exercise/play sports" were deemed active transportation. The prevalence of active transportation was calculated as the proportion reporting any active transportation trip. Data preceding 2001 were not included because different methods were used to solicit walking and bicycling trip data.

ATUS data, collected by the U.S. Bureau of Labor and Statistics, quantifies how U.S. residents spend their time. ATUS uses a stratified random sample of U.S. households that have completed the Current Population Survey. Through a guided telephone interview, ATUS participants give a detailed record of all their activities in the previous day. Activities coded as travel were deemed active transportation if they were reported to occur during walking or bicycling. The prevalence of active transportation was calculated as the proportion reporting any active transportation.

Typical Transportation Behaviors

NHANES is an ongoing, nationally representative health survey with data releases every 2 years. A stratified, multistage probability sample is drawn to obtain a nationally representative sample. Although the NHANES protocol includes multiple components, only interview responses were used in this report. During 1999–2006, participants were asked if they walked or bicycled to get to or from various places in the past 30 days. During 2007–2012, participants were asked if they ever walked or rode a bicycle for at least 10 minutes to get to and from places. The prevalence of active transportation was calculated as the proportion reporting any such behavior. In all cycles, follow-up questions solicited the frequency and duration of active transportation, from which minutes per week of active transportation physical activity could be estimated.

NHIS is an annual health survey of the noninstitutionalized U.S. general population. Although the survey is conducted annually, assessments of walking for transportation are conducted less frequently through a supplemental cancer control module that was last administered in 2005 and 2010. In both years, participants were asked if, in the past 7 days, they walked for at least 10 minutes to get to some place. The prevalence of active transportation was calculated as the proportion reporting any such behavior. Similar to NHANES, follow-up questions asked about the frequency and duration of walking for transportation, allowing estimated minutes per week for the activity.

Data Presentation

Comparing systems that assess different active transportation constructs is difficult. For example, the proportion of adult workers reporting active transportation as the primary commute mode in the past week likely differs from the proportion of all U.S. adults reporting walking in the recent past for transportation. The prevalence of any active transportation based on each system's construct have been plotted to allow a graphical comparison of differences (Figure). Stratified results across time from each system are presented separately.

Stratifying Variables

All five surveillance systems record the sex, age, race/ethnicity, and educational attainment of the respondents. Sex and age are self-reported. For this report, respondents are categorized into one of three age groups: ≤39 years, 40–59 years, or ≥60 years. Age 39 years was chosen as a cutoff point based on nationally representative physical activity data that suggest 40 years is the age at which physical activity begins to decrease with increasing age (*10*). The cutoff point at age 60 years was chosen due to increased frequency of retirement beyond this age (*11*), which might influence transportation patterns. Self-reported educational attainment was recoded in all systems into the following categories: less than high school diploma, high school diploma or general education development certificate, some college or a 2-year degree, and 4-year college degree or higher. Education was chosen as the only indicator of socioeconomic status because comparably complete household income data were not available from all surveillance systems.

Because active transportation is common in urban areas with high population densities (*12*), stratified analyses by these variables were included when available. Before 2012, ACS identified each respondent's area of residence using the PUMA designations from the 2000 census. The University of Missouri Census Data Center's Geocorr12 geographic correspondence engine (*13*) was used to obtain updated population densities for the year 2000 PUMAs and stratify ACS respondents into PUMA population density tertiles: <223 persons per square mile, 223–2,327 persons per square mile, and ≥2,328 persons per square mile. Several PUMAs from the 2000 census were merged after Hurricane Katrina; therefore, updated population densities could not be obtained for these PUMAs, which resulted in the loss of <0.1% of ACS respondents' data from the years 2006–2011. This extra step was not needed for 2012 data as ACS switched to the 2010 decennial census PUMA designations.

TABLE 1. Sampling methods, data collected, and descriptions of surveillance systems that include active transportation assessments — United States, 1999–2012

Data source and website	Sampling method and analytic notes	Data collection	Year	Active transportation assessment questions and calculation
American Community Survey (ACS) http://census.gov/acs/www	ACS uses an address-based, stratified, multistage random sample of households and, starting in 2006, group quarters (>10 inhabitants). ACS includes all eligible household members and a subsample of group quarters. Sample size ranged from 1.9 to 2.5 million persons per year. Commuting assessed in employed respondents aged ≥16 years. Interview response rate is >97.3% in all years. Data missing and imputed for ≤5.9% of eligible respondents each year. Variance estimates were calculated using jackknife replication, using census-supplied weights.	Three-stage follow-up during data collection: mailed questionnaires, computer-assisted telephone interview, and computer-assisted in-person interview (in that order); mandatory participation	2006–2012	"How did this person usually get to work *last week*?" "If this person usually used more than one method of transportation during the trip, mark (X) in the box of the one used for most of the distance." The proportion reporting bicycle or walked was calculated.
National Household Travel Survey (NHTS) http://nhts.ornl.gov	NHTS uses list-assisted, stratified, random-digit dialing of households with landline telephones. Analyses are restricted to respondents aged ≥16 years Trip log: n = 109,714 (2001), n = 229,594 (2009); transportation to work: n = 83,817 (2001), n = 139,068 (2009). Individual response rates range from 36.2% (2001) to 19.8% (2009). Trip data was missing for 11.9% (2001) and 15.2% (2009). Variance estimates were calculated using jackknife replication, using NHTS-supplied weights.	Telephone recruitment, paper trip log, telephone data retrieval interview	2001 and 2009	Participants logged all trips on 1 day, including mode of travel and purpose. Any trip with a mode of bicycle or walk and any purpose other than "go to gym/exercise/play sports" was considered an active transportation trip. The proportion reporting any active transportation was calculated. "How did you usually get to work last week? (the one [mode] used for most of the distance)" The proportion reporting bicycle or walked was calculated.
American Time Use Survey (ATUS) http://bls.gov/tus	ATUS uses a stratified random sample of persons aged ≥15 years from households having completed Current Population Survey interviews. Sample size ranged from 12,248 (2007) to 20,720 (2003). Response rate ranged from 52.5% to 57.8%. Variance was estimated by balanced repeated replication, using weights provided by the U.S. Bureau of Labor Statistics.	Computer-assisted telephone conversational interview, recalling activities from 4 a.m. the previous day to 4 a.m. the day of the interview	2003–2012	For a given time on the day of recall, participants could report a primary activity of travel (code 18). If the location was walking or bicycling, the travel was considered active transportation. The proportion reporting any active transportation was calculated.

NHTS has contracted with Nielsen Claritas, Inc. (New York, New York) to provide estimates of urbanicity and population and residential density from sampled households. Complete documentation is publicly available on the NHTS website (*14*). Urbanicity was scored using a proprietary method that uses the population density of each census block group and neighboring block groups. Each household was classified (by increasing levels of urbanization) as town and country, suburban, second city, or urban. Block-group residential density was divided into groupings of ≤999 and ≥1,000 housing units per square mile. Block-group population density was categorized into groupings of ≤499; 500–1,999; 2,000–9,999; and ≥10,000 persons per square mile. These categories were the only combinations possible because different coding was used in 2001 and 2009.

Physical Activity Guidelines for Americans

The 2008 *Physical Activity Guidelines for Americans* (*15*) recommend that adults participate in at least 150 minutes per week of moderate-intensity aerobic physical activity or 75 minutes per week of vigorous-intensity aerobic physical activity, or an appropriate combination thereof, in bouts of at least 10 minutes. The guidelines do not recommend specific modes by which persons should participate in physical activity, and walking and bicycling for transportation are viable options. The guideline-recommended length of time for participation in physical activity is sufficient to help prevent several chronic diseases and maintain mobility with increasing age (*1*). Although transportation professionals might not need to know the total number of minutes of physical activity obtained through active transportation for planning purposes, public health professionals would likely be interested in whether persons participate in sufficient active transportation to meet this important health-promoting threshold. Therefore, when possible, the analyses in this report calculate the proportion of participants who meet physical activity guidelines through active transportation alone. Because other domains of physical activity are not reported in this assessment, these active transportation estimates should not be mistaken for national estimates of meeting physical activity guidelines.

Because the physical activity guidelines are quantified in minutes per week, only active transportation assessments that measure typical behaviors for a comparable time frame provide useful outcomes. NHANES and NHIS both ask follow-up questions to solicit a participant's typical frequency

TABLE 1. (*Continued*) Sampling methods, data collected, and descriptions of surveillance systems that include active transportation assessments — United States, 1999–2012

Data source and website	Sampling method and analytic notes	Data collection	Year	Active transportation assessment questions and calculation
National Health and Nutrition Examination Survey (NHANES) http://cdc.gov/nchs/nhanes.htm	NHANES uses a stratified multistage probability sample of U.S. residents aged ≥12 years. Number (aged ≥16 years) ranged from 6,035 to 6,888, weighted to represent 207–235 million U.S. residents per 2-year cycle. Adult response rate ranged from 78% to 84%. Data were missing for ≤0.2% of eligible respondents in each 2-year cycle. Variance estimates were calculated using Taylor series linearization.	In-home interview	1999–2006	"Over the past 30 days, have you walked or bicycled as part of getting to and from work, or school, or to do errands?" "How often did you do this [times per day/week/month]?" "On those days when you walked or bicycled, about how long did you spend altogether doing this [in minutes]?" The proportion reporting any transportation walking or bicycling was computed, as was the time spent in participation (in minutes per week).
		Computer-assisted in-home interview	2007–2012	"Do you walk or use a bicycle for at least 10 minutes continuously to get to and from places?" "In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?" "How much time do you spend walking or bicycling for travel on a typical day [in minutes]?" The proportion reporting any transportation walking or bicycling was computed, as was the time spent in participation (in minutes per week).
National Health Interview Survey (NHIS) http://cdc.gov/nchs/nhis.htm	NHIS uses multistage area probability sampling, representative of households and noninstitutional group quarters. Individual respondents were weighted to represent the U.S. general population. Cancer control module was answered by one adult (aged ≥18 years) per household. Final adult response rate ranged from 69.0% (2005) to 60.8% (2010). Data was complete for 94.5% (2005, n = 29,689) and 93.7% (2010, n = 25,438). Variance estimates were calculated using Taylor series linearization.	Personal household interview	2005	"First I will ask about walking for transportation that is, walking to get some place. Please include all walks that involved an errand or to get some place. During the past 7 days, did you walk to get to some place that took you at least 10 minutes?" "During the past 7 days, on how many days did you walk for at least 10 minutes at a time to get some place such as work, school, a store, or restaurant?" "How much time did you usually spend on one of those days walking to get from place to place?" The proportion reporting any transportation walking was computed, as was the time spent in participation (in minutes per week).
			2010	"The next questions are about walking for transportation: During the past 7 days, did you walk to get some place that took you at least 10 minutes? In the past 7 days, how many times did you do that? On average, how long did those walks take?" The proportion reporting any transportation walking was computed, as was the time spent in participation (in minutes per week).

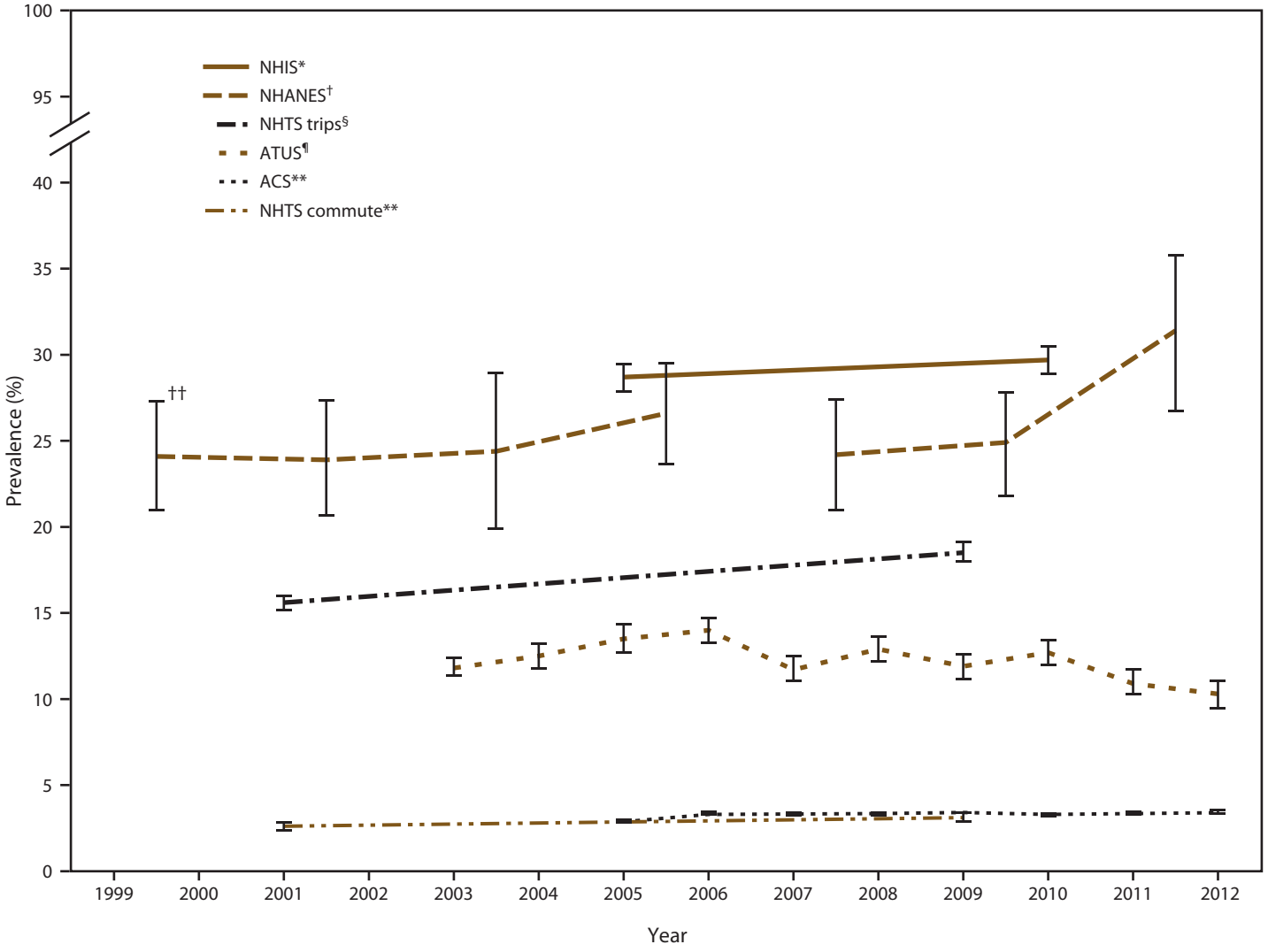
and duration of active transportation (Table 1). During 1999–2006, NHANES asked the number of times per day, week, or month that the participant participated in active transportation then asked the number of minutes per day the participant participated in active transportation on those days. Determining minutes per week using times and days required three assumptions. First, if the frequency was reported as times per day (26% of respondents), then the respondent was assumed to have participated in daily active transportation, and the daily duration was multiplied by seven to attain minutes per week. Second, if the frequency was reported as times per week (46% of respondents), this was considered to be days per week, and the daily duration was multiplied by the frequency to attain minutes per week. Third, if the frequency was reported as times per month (28% of respondents), this was considered to be days per month, and the product of the daily duration and frequency were divided by 4.33 (52 weeks ÷ 12 months) to attain minutes per week. In the 2007–2012 NHANES, the follow-up questions were changed and the units were concordant with the guidelines; respondents reported frequency as the number of days in a

typical week with at least 10 minutes of active transportation and reported duration as minutes of active transportation on a typical day, allowing a simple calculation of minutes per week.

In the 2005 cancer control supplement to NHIS, participants were asked on how many days during the past 7 they had walked for transportation. They were next asked how much time they usually spent participating in active transportation on one of those days. In 2010, the frequency item changed and the participants were asked the number of times they walked for transportation in the past 7 days and then how long those walks usually took. In both cases, the minutes of active transportation per week were calculated as frequency times duration.

NHANES guidelines from 1999–2012 recommend classifying transportation-related walking and bicycling as moderate intensity physical activity. Therefore, after calculating minutes of active transportation performed per week, respondents who reported ≥150 minutes were classified as meeting guidelines, and those with <150 minutes were classified as not meeting guidelines. Meeting guidelines was calculated through active transportation alone; however, persons who did not meet guidelines though active transportation might have done so through other means (e.g., leisure-time physical activity).

FIGURE. Prevalence of active transportation (walking or bicycling) — five surveillance systems, United States, 1999–2012



Abbreviations: ACS = American Community Survey; ATUS = American Time Use Survey; NHANES = National Health and Nutrition Examination Survey; NHIS = National Health Interview Survey; NHTS = National Household Travel Survey.

* NHIS: any walking for transportation in the past week.

† NHANES 1999–2006: any walking or bicycling for transportation in the past month; 2007–2012: any recent walking or bicycling for transportation.

§ NHTS trips: any trips with a mode of walking or bicycling on a given day.

¶ ATUS: any activity reported as transportation while walking or bicycling on a given day.

** ACS and NHTS commute: walking or bicycling reported as primary commute mode to work in the past week.

†† 95% confidence interval.

Statistical Analyses

All analyses were conducted following the analytic guidelines of each system. Statistical software was used to account for complex sampling designs and population weighting. System-specific methods including variance estimation were used to estimate 95% confidence intervals (CIs) for point estimates (Table 1).

Statistical testing was performed to determine whether active transportation was associated with the covariates. The Rao-Scott modified chi-square test was used to account for the complex survey design (*16*). When required for selected pairwise comparisons, a Wald chi-square test with Bonferroni correction was used to account for multiple comparisons. Tests for overall trends in systems with three or more comparable data points were performed with weighted linear regression; year was used as the independent variable, and the point estimate was the dependent variable. Analytic weights were calculated as the inverse of the standard error for the estimate in question. For all analyses, tests of significance were conducted ($\alpha = 0.05$).

Results

Overall Prevalence Among Systems

The estimated prevalence of each system's active transportation construct (with 95% CIs) was plotted across time (Figure). The magnitudes of the estimates for related constructs are similar. The prevalence of active transportation as the primary past-week commute mode to work (ACS and NHTS) ranged from a low of 2.6% in the 2001 NHTS to highs of 3.4% in ACS for the years 2008, 2009, and 2011. The prevalence of any active transportation from a single-day assessment ranged from a low of 10.5% in the 2012 ATUS to 18.5% in the 2009 NHTS. The prevalence of any habitual active transportation in behavioral assessments ranged from 23.9% in the 2001–2002 NHANES to 31.4% in the 2011–2012 NHANES.

Assessments

Transportation to Work

The overall prevalence of walking or bicycling as the primary past-week commute mode to work was estimated from ACS data to be 2.9% in 2005 and 3.3%–3.4% in 2006–2012 (Table 2). In all years, men reported a slightly higher prevalence than women. Age was significantly associated with active transportation in all years. Respondents aged ≥60 years consistently reported more active transportation than those aged 40–59 years, in contrast with documented age-related decreases in leisure activity. Respondents identifying as Hispanic (of any race) and non-Hispanic other (not white or black) reported more active commuting than non-Hispanic

TABLE 2. Percentage of respondents who reported walking or bicycling as primary commute mode to work in the past week — American Community Survey, United States, 2005–2012

	2005		2006		2007		2008		2009		2010		2011		2012	
Characteristic	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**
Sex*																
Male	3.1	(3.1–3.2)	3.5	(3.5–3.6)	3.5	(3.5–3.6)	3.6	(3.5–3.7)	3.7	(3.6–3.8)	3.6	(3.5–3.6)	3.6	(3.6–3.7)	3.7	(3.7–3.8)
Female	2.6	(2.5–2.7)	3.1	(3.0–3.1)	3.1	(3.1–3.1)	3.1	(3.0–3.1)	3.1	(3.1–3.2)	3.0	(2.9–3.0)	3.1	(3.0–3.1)	3.1	(3.1–3.2)
Age group (yrs)*																
16–39	3.3	(3.3–3.4)	4.1	(4.1–4.2)	4.2	(4.1–4.3)	4.3	(4.2–4.4)	4.5	(4.4–4.6)	4.4	(4.3–4.4)	4.5	(4.5–4.6)	4.7	(4.6–4.8)
40–59	2.3	(2.3–2.4)	2.4	(2.4–2.5)	2.4	(2.4–2.5)	2.5	(2.4–2.5)	2.4	(2.4–2.5)	2.3	(2.3–2.4)	2.3	(2.3–2.4)	2.3	(2.3–2.4)
≥60	3.1†	(3.0–3.3)	3.1†	(3.0–3.2)	3.2†	(3.1–3.3)	2.9†	(2.8–3.0)	2.8†	(2.7–2.9)	2.8†	(2.7–2.9)	2.6†	(2.5–2.7)	2.7†	(2.6–2.8)
Race/Ethnicity*																
White, non-Hispanic	2.7	(2.6–2.7)	3.1	(3.1–3.2)	3.1	(3.1–3.2)	3.2	(3.1–3.2)	3.2	(3.2–3.3)	3.1	(3.1–3.1)	3.1	(3.1–3.2)	3.2	(3.2–3.3)
Black, non-Hispanic	2.6	(2.4–2.7)	3.0	(2.9–3.2)	3.1	(3.0–3.2)	3.2	(3.0–3.3)	3.0	(2.9–3.2)	2.9	(2.7–3.0)	3.1	(3.0–3.2)	3.1	(3.0–3.3)
Other, non-Hispanic	3.9§	(3.7–4.1)	4.5§	(4.3–4.7)	4.6§	(4.3–4.8)	4.5§	(4.3–4.6)	4.6§	(4.4–4.8)	4.6§	(4.4–4.8)	4.7§	(4.5–4.9)	4.7§	(4.6–4.9)
Hispanic	3.7§	(3.5–3.8)	3.9§	(3.8–4.1)	3.9§	(3.8–4.1)	3.8§	(3.7–4.0)	4.0§	(3.8–4.1)	3.9§	(3.8–4.0)	4.0§	(3.9–4.1)	4.0§	(3.8–4.1)
Education*																
<High school	4.7¶	(4.6–4.9)	5.0¶	(4.8–5.1)	5.1¶	(4.9–5.2)	5.0¶	(4.9–5.2)	5.1¶	(5.0–5.3)	5.0¶	(4.8–5.1)	4.9¶	(4.7–5.0)	5.1¶	(4.9–5.2)
High school diploma or GED	2.7	(2.7–2.8)	3.2	(3.1–3.3)	3.2	(3.1–3.2)	3.2	(3.2–3.3)	3.3	(3.2–3.4)	3.1	(3.0–3.2)	3.2	(3.1–3.2)	3.3	(3.2–3.3)
Some college	2.3	(2.3–2.4)	3.2	(3.1–3.2)	3.2	(3.1–3.3)	3.1	(3.1–3.2)	3.3	(3.2–3.4)	3.2	(3.1–3.3)	3.3	(3.2–3.4)	3.4	(3.3–3.4)
College graduate	2.8	(2.8–2.9)	2.9	(2.8–3.0)	3.0	(2.9–3.1)	3.1	(3.0–3.2)	3.1	(3.0–3.2)	3.0	(3.0–3.1)	3.1	(3.0–3.2)	3.2	(3.1–3.2)
Population density (no. of persons per square mile)*																
<223	2.9**	(2.8–2.9)	3.3**	(3.2–3.3)	3.3**	(3.2–3.4)	3.2**	(3.1–3.3)	3.2**	(3.1–3.3)	3.1**	(3.0–3.1)	3.2**	(3.1–3.2)	3.1**	(3.0–3.1)
223–2,327	1.9	(1.8–2.0)	2.3	(2.3–2.4)	2.3	(2.2–2.3)	2.3	(2.2–2.3)	2.3	(2.2–2.3)	2.1	(2.1–2.2)	2.2	(2.2–2.3)	2.4	(2.3–2.4)
≥2,328	4.0	(3.9–4.0)	4.4	(4.3–4.5)	4.5	(4.4–4.6)	4.7	(4.6–4.7)	4.8	(4.8–4.9)	4.8	(4.7–4.9)	4.8	(4.7–4.9)	4.9	(4.8–5.0)
Total	**2.9**	**(2.8–2.9)**	**3.3**	**(3.3–3.4)**	**3.3**	**(3.3–3.4)**	**3.4**	**(3.3–3.4)**	**3.4**	**(3.4–3.5)**	**3.3**	**(3.3–3.3)**	**3.4**	**(3.3–3.4)**	**3.4**	**(3.4–3.5)**

Abbreviations: CI = confidence interval; GED = General Education Development certificate.
* All covariates were significantly associated with commuting prevalence (p<0.001, Rao Scott corrected chi-square test).
† Significantly different from age 40–45 years (p<0.001, Wald chi-square test).
§ Combined Hispanic and non-Hispanic other significantly different from combined non-Hispanic white and non-Hispanic black (p<0.001).
¶ Significantly different from other education categories combined (p<0.001, Wald chi-square test).
** Significantly different from 223–2,327 persons per square mile (p<0.001, Wald chi-square test).

whites and non-Hispanic blacks in all years. In addition, respondents who reported attaining less than a high school education consistently reported more active commuting than their more educated counterparts. Active commuting was associated with PUMA population density in all years. Although active commuting was markedly (and expectedly) high in the most densely populated PUMAs, respondents in the least densely populated PUMAs consistently reported more active commuting than those living in PUMAs of intermediate population density.

The overall estimates of walking or bicycling as the primary past-week commute mode to work from NHTS (Table 3) were comparable with ACS estimates at 2.6% in 2001 and 3.1% in 2009. Estimates across sex, age, race/ethnicity, and education strata exhibited similar patterns to those found in ACS, although no differences were found between sexes (in 2001) and among racial/ethnic groups (in 2009) (p = 0.11 and p = 0.63, respectively). Active commuting occurred more in areas with greater urbanicity: residents of urban areas reported significantly more active commuting than residents in the three classes of nonurban areas. Similarly, persons living in census block groups with high residential density reported more active commuting than those in areas with low residential density. Population density at the block group level was associated with active commuting in both years, and those living in the most densely populated block groups reported more active commuting than residents of less densely populated block groups.

Single Day

The overall prevalence of nonexercise walking or bicycling trips on a given single day among NHTS participants was higher in 2009 (18.5%) than in 2001 (15.6%) (Table 4).

TABLE 3. Percentage of respondents who reported walking or bicycling as primary commute mode to work in the past week — National Household Travel Survey, United States, 2001 and 2009

	2001			2009		
Characteristic	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**
Sex			p = 0.11			p<0.001
Male	2.8	(2.5–3.1)		3.5	(3.1–4.0)	
Female	2.5	(2.2–2.8)		2.6	(2.2–3.0)	
Age group (yrs)			p<0.001			p<0.001
16–39	3.0	(2.7–3.4)		4.0	(3.4–4.6)	
40–59	2.1	(1.8–2.3)		2.4	(2.1–2.8)	
≥60	2.9	(2.2–3.6)		2.7	(2.2–3.1)	
Race/Ethnicity			p = 0.01			p = 0.63
White, non-Hispanic	2.4	(2.2–2.6)		3.0	(2.7–3.4)	
Black, non-Hispanic	2.9	(2.2–3.7)		3.3	(2.1–4.4)	
Other, non-Hispanic	3.8	(2.6–4.9)		3.7	(2.7–4.7)	
Hispanic	3.2	(2.5–4.0)		3.3	(2.7–3.9)	
Education			p<0.001			p<0.001
<High school	4.3	(3.2–5.4)		7.0	(5.3–8.6)	
High school diploma or GED	2.4	(2.0–2.8)		2.8	(2.2–3.5)	
Some college	2.3	(2.0–2.6)		2.6	(2.2–3.0)	
College graduate	2.7	(2.3–3.0)		2.9	(2.5–3.3)	
Urbanicity*			p<0.001			p<0.001
Town and country	1.7	(1.5–2.0)		2.3	(2.0–2.7)	
Suburban	1.8	(1.4–2.2)		2.5	(1.8–3.1)	
Second city	3.4	(2.8–4.0)		3.3	(2.6–4.1)	
Urban	5.4†	(4.6–6.2)		5.8†	(4.8–6.7)	
Residential density (no. of housing units per square mile)			p<0.001			p<0.001
0–999	1.6	(1.4–1.8)		2.2	(1.9–2.5)	
≥1,000	3.7	(3.4–4.1)		4.1	(3.6–4.7)	
Population density (no. of persons per square mile)			p<0.001			p<0.001
≤499	1.8	(1.5–2.1)		2.1	(1.6–2.5)	
500–1,999	1.2	(0.9–1.4)		2.0	(1.6–2.4)	
2,000–9,999	2.5	(2.1–2.8)		3.3	(2.8–3.8)	
≥10,000	7.0§	(6.0–8.1)		6.7§	(5.4–7.9)	
Total	**2.6**	**(2.4–2.9)**		**3.1**	**(2.8–3.4)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate.

* Urbanicity was scored using a proprietary method that uses the population density of each census block group and neighboring block groups. Each household was classified (by increasing levels of urbanization) as town and country, suburban, second city, or urban. Block-group residential density was divided into groupings of ≤999 and ≥1,000 housing units per square mile. Block-group population density was categorized into groupings of ≤499; 500–1,999; 2,000–9,999; and ≥10,000 persons per square mile.

† Significantly different from other urbanicity categories combined (p<0.001).

§ Significantly different from other population densities combined (p<0.001).

Although women reported a higher prevalence than men in 2001 (16.4% versus 14.8%, respectively; p<0.001), no difference was found in 2009 (18.4% versus 18.6%, respectively; p = 0.62). In both years, the youngest age group (≤39 years) reported the highest prevalence of active transportation (16.4% in 2001 and 19.8% in 2009). Among racial/ethnic groups in both years, non-Hispanic whites reported less active transportation than did respondents of other racial/ethnic groups. In addition, participants in either the highest or lowest educational attainment reported more active transportation than those in the two intermediate education categories. As in the transportation-to-work assessment, the prevalence of active trips was higher among persons in more urban areas. Residents of urban areas reported active trips more than twice as frequently as town and country residents (urban, 28.9% in 2001 and 30.9% in 2009; town and country, 11.2% in 2001 and 13.3% in 2009). Participants living in block groups with higher residential density reported more active transportation than those living in areas with lower residential density. Population density at the block group level also was associated with active transportation; active transportation was approximately twofold higher in block groups with ≥10,000 people per square mile compared with those with 2,000–9,999 people per square mile (2001, 32.8% versus 15.6%; 2009, 36.6% versus 18.6%).

For the population overall, the prevalence of past-day transportation via walking or bicycling according to ATUS data increased steadily, from 11.8% in 2003 to 14.0% in 2006. Prevalence then varied between 11.7% in 2007 and 12.7% in 2010 before decreasing in 2011 and 2012 to 10.9% and 10.3%, respectively (Table 5). No statistically significant linear trend over time was detected (p = 0.15), and no consistent differences were found between men and women

TABLE 4. Percentage of respondents who reported any nonexercise walking or bicycling trip in a 1-day trip log — National Household Travel Survey, United States, 2001 and 2009

	2001			2009		
Characteristic	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**
Sex			p<0.001			p = 0.62
Male	14.8	(14.3–15.3)		18.4	(17.7–19.1)	
Female	16.4	(15.8–16.9)		18.6	(17.9–19.4)	
Age group (yrs)			p<0.001			p<0.001
16–39	16.4	(15.7–17.2)		19.8	(18.8–20.7)	
40–59	14.6	(13.9–15.2)		18.6	(17.8–19.3)	
≥60	15.5	(14.6–16.4)		16.1	(15.3–16.8)	
Race/Ethnicity			p<0.001			p<0.001
White, non-Hispanic	14.7*	(14.2–15.2)		17.3*	(16.8–17.9)	
Black, non-Hispanic	18.3	(16.7–19.8)		19.9	(17.9–21.9)	
Other, non-Hispanic	16.8	(14.5–19.1)		19.4	(17.3–21.4)	
Hispanic	18.3	(16.7–19.9)		22.5	(20.7–24.2)	
Education			p<0.001			p<0.001
<High school	17.4†	(15.6–19.1)		22.7†	(21.0–24.3)	
High school diploma or GED	13.9	(13.2–14.8)		15.1	(14.1–16.0)	
Some college	14.0	(13.2–14.8)		15.9	(15.0–16.8)	
College graduate	18.2†	(17.5–19.0)		22.1†	(21.3–23.0)	
Urbanicity§			p<0.001			p<0.001
Town and country	11.2	(10.6–11.7)		13.3	(12.7–13.8)	
Suburban	13.6	(12.9–14.3)		18.2	(17.1–19.2)	
Second city	17.0	(15.8–18.3)		18.6	(17.4–19.7)	
Urban	28.9	(27.6–30.2)		30.9	(29.0–32.7)	
Residential density (no. of housing units per square mile)			p<0.001			p<0.001
0–999	11.0	(10.5–11.5)		13.9	(13.3–14.5)	
≥1000	20.4	(19.7–21.2)		23.2	(22.2–24.1)	
Population density (no. of persons per square mile)			p<0.001			p<0.001
≤499	10.1	(9.5–10.8)		12.2	(11.5–12.9)	
500–1,999	12.1	(11.2–12.9)		15.6	(14.4–16.7)	
2,000–9,999	15.6	(14.9–16.4)		18.6	(17.7–19.4)	
≥10,000	32.8	(31.3–34.2)		36.6	(34.2–39.0)	
Total	**15.6**	**(15.2–16.0)**		**18.5**	**(18.0–19.1)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate.

* Significantly different from other races/ethnicities combined (p<0.001, Wald chi-square test).

† Significantly different from combined intermediate education categories (high school diploma or GED, some college) (p<0.001, Wald chi-square test).

§ Urbanicity was scored using a proprietary method that uses the population density of each census block group and neighboring block groups. Each household was classified (by increasing levels of urbanization) as town and country, suburban, second city, or urban. Block-group residential density was divided into groupings of ≤999 and ≥1,000 housing units per square mile. Block-group population density was categorized into groupings of ≤499; 500–1,999; 2,000–9,999; and ≥10,000 persons per square mile.

across time. Participants aged ≤39 years consistently reported more active transportation than older participants (p<0.001, all years). Among racial/ethnic groups, non-Hispanic whites consistently reported less frequent active transportation than did other racial/ethnic groups (p<0.001, all years). When stratified by education, the prevalence of active transportation was consistently highest among those with less than a high school education compared with all other groups (p<0.02, Bonferroni adjusted). In half of the years, no difference between the most and least educated groups was detected (2006, 2008, 2009, 2010, and 2012; p>0.05, Bonferroni adjusted).

Typical Transportation Behavior

According to 1999–2006 NHANES data, the overall prevalence of past 30-day walking or bicycling for transportation ranged from 23.9% in 2001–2002 to 26.6% in 2005–2006. The prevalence of recent walking or bicycling for transportation (2007–2012) ranged from 24.2% in 2007–2008 to 31.4% in 2011–2012 (Table 6). Comparisons before and after the assessment change in 2007 should be interpreted with caution. For the four cycles during 1999–2006, no linear trend over time was detected in overall active transportation estimates (p = 0.14). Likewise, no linear trend over time was detected for the three cycles during 2007–2012, despite a sharp increase in active transportation in 2011–2012 (p = 0.33). Active transportation prevalence estimates for men were slightly higher than those for women in all years except 1999–2000, when no differences were detected (p = 0.08). Participants aged ≤39 years reported more active transportation than older respondents (p<0.001 for all years). Active transportation was significantly associated with race/ethnicity in three of seven NHANES cycles examined (p = 0.02 for 2003–2004 and 2007–2008 and p<0.001 for 2009–2010). In years with significant differences across racial/ethnic groups, non-Hispanic whites reported less active transportation than did other racial/ethnic groups (p<0.004 for 2003–2004, 2007–2008, and 2009–2010). Educational attainment was associated with active transportation prevalence in six of seven NHANES cycles (p<0.03, six cycles during 1999–2010); only in 2011–2012 was no association with education found (p = 0.09). The most educated participants reported more active transportation than less educated participants during 1999–2006 (p<0.05, all cycles). After the assessment change in 2007, the least educated participants reported more active transportation than other groups during 2007–2010 (p<0.002, both cycles).

According to NHIS data, the overall prevalence of past-week walking for transportation of at least 10 minutes was 28.7% in 2005 and 29.7% in 2010 (Table 7). In both years, men reported a higher prevalence than women (30.7% versus 26.8% in 2005, 32.6% versus 27.0% in 2010). Active transportation was associated with age in both years, and a statistically significant linear trend for higher active transportation was found in ascending age categories in 2010 (p = 0.04). Among racial/ethnic groups, non-Hispanic whites reported less active transportation than did other racial/ethnic groups. Regarding education, participants with a college degree or higher reported more active transportation than less educated groups.

TABLE 5. Percentage of respondents who reported walking or bicycling for transportation in the past 24 hours — American Time Use Survey, United States, 2003–2012

	2003			2004			2005			2006			2007		
Characteristic	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**
Sex			p = 0.009			p = 0.38			p = 0.57			p = 0.97			p = 0.94
Male	11.0	(10.2–11.8)		12.9	(11.7–14.1)		13.2	(11.9–14.6)		14.1	(12.8–15.3)		11.8	(10.6–13.0)	
Female	12.6	(11.8–13.3)		12.2	(11.2–13.1)		13.7	(12.7–14.7)		14.0	(12.9–15.1)		11.7	(10.7–12.7)	
Age group (yrs)			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
16–39	14.8*	(13.9–15.7)		15.9*	(14.5–17.3)		17.1*	(15.5–18.7)		17.7*	(16.3–19.1)		15.8*	(14.4–17.2)	
40–59	10.4	(9.5–11.3)		9.9	(8.9–10.9)		10.9	(9.8–12.0)		12.4	(11.3–13.6)		8.9	(8.0–9.8)	
≥60	8.1	(7.1–9.0)		10.1	(9.0–11.3)		10.6	(9.2–12.0)		9.6	(8.3–10.8)		8.5	(7.2–9.9)	
Race/Ethnicity			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
White, non-Hispanic	10.0†	(9.4–10.5)		10.5†	(9.6–11.4)		11.8†	(10.9–12.7)		12.3†	(11.3–13.2)		10.2†	(9.3–11.0)	
Black, non-Hispanic	16.3	(14.4–18.2)		17.4	(14.8–20.0)		17.1	(15.0–20.3)		18.3	(15.7–20.9)		15.5	(12.8–18.1)	
Other, non-Hispanic	14.3	(11.1–17.4)		15.6	(11.0–20.3)		14.7	(11.1–18.3)		16.6	(11.9–21.3)		18.4	(13.9–22.9)	
Hispanic	17.7	(15.6–19.8)		18.3	(15.7–20.9)		18.8	(16.2–21.5)		18.9	(16.5–21.3)		14.2	(11.8–16.6)	
Education			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
<High school	15.9§	(14.3–17.6)		17.0§	(14.9–19.2)		19.9§	(17.8–21.9)		17.4§	(15.3–19.4)		16.5§	(14.0–18.9)	
High school or GED	9.8	(8.8–10.8)		10.4	(9.1–11.7)		11.5	(10.0–13.1)		11.2	(9.9–12.5)		9.8	(8.6–11.0)	
Some college	10.4	(9.3–11.5)		11.3	(9.8–12.7)		12.0	(10.4–13.7)		13.5	(11.9–15.1)		10.9	(9.4–12.4)	
College graduate	12.8	(11.7–13.8)		13.1	(11.8–14.5)		12.9	(11.7–14.0)		15.6	(14.1–17.2)		11.7	(10.4–13.1)	
Total	**11.8**	**(11.3–12.4)**		**12.5**	**(11.7–13.3)**		**13.5**	**(12.6–14.3)**		**14.0**	**(13.3–14.8)**		**11.7**	**(11.0–12.5)**	

See table footnotes on next page.

Active Transportation and *Physical Activity Guidelines for Americans*

In the four NHANES cycles during 1999–2006, the proportion of respondents who met the aerobic physical activity guideline through active transportation ranged from a high of 7.9% in 1999–2000 to 6.0% in 2000–2001 (Table 8). No significant linear trend in the proportion over time was detected (p = 0.62). After the assessment change in 2007, the proportion was much higher: 13.0% in 2007–2008, 13.2% in 2009–2010, and 18.0% in 2011–2012. In these three cycles, no significant linear trend over time was found (p = 0.36). Men reported a higher prevalence of meeting guidelines than women in five of the seven cycles (1999–2000, p = 0.04; 2001–2002, p = 0.02; and 2007–2008, 2009–2010 and 2011–2012, p<0.001). The proportion meeting guidelines was associated with age in all seven cycles (p<0.05 for all years). Respondents aged ≤39 years consistently met guidelines more frequently than older respondents (p<0.03 in all cycles). In five of seven cycles in which the proportion meeting physical activity guidelines was associated with race/ethnicity (all cycles except 2005–2006 and 2011–2012), non-Hispanic whites consistently met guidelines less frequently than participants of other racial/ethnic groups (p<0.04, all cycles). Meeting guidelines through active transportation was associated with educational attainment in three of seven cycles (1999–2000, 2007–2008, and 2009–2010). In those three cycles, participants reporting less than a high school education reported meeting guidelines through active transportation more frequently than did other educational groups (p<0.02 for the three cycles).

For NHIS, the overall prevalence of meeting guidelines through active transportation (walking only) was 6.5% in 2005 and 4.7% in 2010. Men reported meeting guidelines through active transportation more frequently than women. The proportion reporting ≥150 minutes active transportation was associated with age in both years, although no linear trend was detected (p = 0.12 and 0.24 in 2005 and 2010, respectively). Like the findings from NHANES, non-Hispanic whites consistently met guidelines less frequently than all other groups. Among education categories, those with a high school diploma or equivalent reported meeting guidelines through transportation-related walking less frequently than those in other education categories (p<0.05, both years).

Discussion

Overall Results

The results in this report suggest that the prevalence of active transportation varies by a factor of 10, based on the definition of the active transportation construct being assessed. Systems assessing the primary mode of transportation to work in the past week exhibited the lowest prevalence, with overall estimates from ACS and NHTS ranging from 2.6% to 3.4%. Systems assessing transportation or activities on a single day, such as NHTS trip logs and ATUS, resulted in overall prevalence estimates ranging from 10.5% to 18.5%. Systems assessing

TABLE 5. (*Continued*) Percentage of respondents who reported walking or bicycling for transportation in the past 24 hours — American Time Use Survey, United States, 2003–2012

	2008			2009			2010			2011			2012		
Characteristic	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**
Sex			p = 0.69			p = 0.95			p = 0.14			p = 0.18			p = 0.02
Male	12.7	(11.6–13.9)		11.9	(10.7–13.1)		13.3	(12.2–14.3)		11.5	(10.3–12.7)		11.1	(10.1–12.2)	
Female	13.0	(12.0–14.1)		11.9	(10.9–12.8)		12.2	(11.1–13.2)		10.4	(9.4–11.4)		9.6	(8.6–10.5)	
Age group (yrs)			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
16–39	16.6*	(15.1–18.1)		16.0*	(14.6–17.4)		16.4*	(15–17.7)		14.9*	(13.5–16.4)		14.0*	(12.6–15.5)	
40–59	10.7	(9.6–11.8)		10.0	(8.9–11.0)		11.2	(10.1–12.3)		9.1	(8.2–10.0)		8.4	(7.3–9.5)	
≥60	9.4	(8.2–10.6)		7.4	(6.4–8.4)		8.4	(7.2–9.5)		6.7	(5.6–7.8)		6.9	(5.6–8.1)	
Race/Ethnicity			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
White, non-Hispanic	11.1†	(10.3–12.0)		9.8†	(8.9–10.6)		11.2†	(10.3–12.0)		9.1†	(8.3–10.0)		9.2†	(8.3–10.1)	
Black, non-Hispanic	16.7	(14.0–19.3)		15.6	(13.1–18.2)		17.8	(15.5–20.2)		16.0	(13.6–18.3)		13.4	(11.2–15.6)	
Other, non-Hispanic	16.3	(11.2–21.4)		17.9	(13.9–22.0)		14.3	(11.0–17.7)		15.1	(10.9–19.2)		15.0	(11.3–18.7)	
Hispanic	17.3	(14.9–19.7)		17.4	(14.8–20.0)		15.2	(13.2–17.3)		13.7	(11.7–15.8)		11.0	(9.0–13.1)	
Education			p<0.001			p<0.001			p<0.001			p<0.001			p<0.001
<High school	15.4§	(13.2–17.6)		15.0§	(13.1–16.9)		16.1§	(13.9–18.2)		15.7§	(13.4–17.9)		12.4§	(10.2–14.6)	
High school or GED	11.3	(9.8–12.8)		10.6	(9.1–12.1)		10.0	(8.7–11.2)		8.7	(7.3–10.0)		8.5	(7.3–9.8)	
Some college	11.3	(9.7–12.8)		9.6	(8.2–11.0)		11.8	(10.3–13.3)		9.3	(8.1–10.6)		8.5	(7.1–9.9)	
College graduate	14.5	(12.9–16.1)		13.6	(12.2–15.0)		14.3	(12.9–15.7)		12.2	(10.8–13.6)		12.7	(11.3–14.0)	
Total	**12.9**	**(12.1–13.7)**		**11.9**	**(11.1–12.7)**		**12.7**	**(12.0–13.4)**		**10.9**	**(10.2–11.7)**		**10.3**	**(9.5–11.1)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate.
* Significantly different from other age groups combined (p<0.001, Wald chi-square test).
† Significantly different from other races/ethnicities combined (p<0.001, Wald chi-square test).
§ Significantly different from other education categories combined (p<0.001) except 2008 (p = 0.006) and 2012 (p = 0.01, all Wald chi-square tests).

TABLE 6. Percentage of respondents who reported any walking or bicycling for transportation — National Health and Nutrition Examination Survey, United States, 1999–2012*

Characteristic	1999–2000 % (95% CI)	p value	2001–2002 % (95% CI)	p value	2003–2004 % (95% CI)	p value	2005–2006 % (95% CI)	p value	2007–2008 % (95% CI)	p value	2009–2010 % (95% CI)	p value	2011–2012 % (95% CI)	p value
Sex		p = 0.08		p<0.001		p = 0.009		p = 0.004		p = 0.02		p = 0.005		p<0.001
Male	25.1 (21.4–28.9)		25.2 (21.6–28.9)		26.6 (21.8–31.4)		28.4 (25.8–30.9)		26.3 (22.0–30.5)		27.2 (23.6–30.8)		34.8 (28.9–40.7)	
Female	23.2 (20.1–26.2)		22.7 (19.6–25.9)		22.4 (17.6–27.3)		24.9 (21.2–28.6)		22.3 (19.1–25.5)		22.7 (19.4–25.9)		28.3 (22.3–34.3)	
Age group (yrs)		p<0.001		p<0.001		p<0.001		p<0.001		p<0.001		p<0.001		p<0.001
16–39	27.3† (24.0–30.7)		28.6† (24.4–32.8)		30.5† (24.5–36.5)		32.2† (27.5–36.9)		30.0† (26.0–34.1)		31.0† (27.5–34.6)		40.3† (31.9–48.6)	
40–59	20.9 (16.3–25.4)		20.5 (16.5–24.5)		21.8 (17.3–26.3)		24.5 (22.2–26.8)		21.9 (17.5–26.3)		23.7 (19.9–27.5)		28.7 (23.1–34.3)	
≥60	21.4 (17.5–25.3)		19.2 (16.6–21.8)		16.4 (12.9–19.8)		18.8 (16.7–21.0)		16.9 (13.4–20.3)		15.5 (13.0–18.0)		20.6 (17.4–23.9)	
Race/ Ethnicity		p = 0.19		p = 0.28		p = 0.02		p = 0.17		p = 0.02		p<0.001		p = 0.12
White, non-Hispanic	23.7 (19.7–27.6)		24.5 (20.5–28.5)		22.5 (18.1–27.0)§		25.3 (21.9–28.7)		22.2 (19.6–24.8)§		21.5§ (17.9–25.0)		29.3 (22.7–35.9)	
Black, non-Hispanic	25.5 (21.0–30.0)		23.1 (20.2–26.0)		29.8 (23.4–36.1)		30.4 (25.6–35.3)		24.1 (19.5–24.6)		33.9 (29.2–38.6)		35.7 (27.5–43.8)	
Other, non-Hispanic	31.6 (22.4–40.8)		19.4 (13.0–25.8)		32.9 (21.8–44.0)		30.0 (20.9–39.0)		30.9 (17.1–44.7)		28.3 (21.5–35.1)		37.0 (27.5–46.4)	
Hispanic	22.6 (18.8–26.3)		23.3 (20.4–26.2)		26.6 (20.7–32.6)		28.9 (24.0–33.9)		31.6 (25.6–37.6)		31.8 (25.2–38.4)		34.6 (27.6–41.6)	
Education		p = 0.03		p = 0.02		p<0.001		p = 0.03		p = 0.003		p<0.001		p = 0.09
<High school	24.5 (20.7–28.2)		23.6 (20.6–26.6)		25.1 (19.7–30.6)		27.1 (23.6–30.7)		29.5¶ (24.8–34.3)		30.6¶ (27.4–33.8)		32.9 (29.1–36.7)	
High school or GED	21.3 (18.0–24.7)		20.5 (16.0–24.9)		21.0 (16.4–25.5)		22.8 (18.8–26.8)		21.5 (17.4–25.6)		20.1 (16.5–23.6)		24.4 (18.2–30.6)	
Some college	22.4 (19.1–25.7)		23.8 (20.3–27.3)		21.8 (16.7–26.9)		25.6 (21.5–29.8)		24.7 (20.3–29.2)		24.1 (20.6–27.5)		33.2 (24.1–42.3)	
College graduate	29.4¶ (22.4–36.4)		28.1¶ (22.3–33.9)		31.6¶ (25.3–37.8)		31.1¶ (25.6–36.7)		21.0 (16.1–25.9)		24.9 (19.5–30.3)		33.4 (24.8–41.9)	
Total	**24.1 (20.9–27.3)**		**23.9 (20.6–27.3)**		**24.4 (19.9–29.0)**		**26.6 (23.6–29.5)**		**24.2 (20.9–27.6)**		**24.9 (21.8–27.9)**		**31.4 (25.6–37.3)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate.
* 1999–2006 assessed walking or bicycling in past 30 days for transportation of any duration; 2007–2010 assessed any walking or bicycling for transportation for at least 10 minutes.
† Significantly different from other age groups combined (p<0.001, Wald chi-square test).
§ Significantly different from other race/ethnicities combined (p<0.001 for 2003–2004 and 2007–2009, p = 0.042 for 2007–2008, Wald chi-square tests).
¶ Significantly different from other education groups combined (p = 0.01 for 1999–2000, p = 0.02 for 2001–2002, p<0.001 for 2003–2004, p = 0.05 for 2005–2006, p = 0.001 for 2007–2008, and p<0.001 for 2009–2010, all Wald chi-square tests).

typical or habitual active transportation behaviors resulted in the highest prevalence, with overall estimates from NHANES and NHIS ranging from 24.1% to 31.4%. These discrepant findings likely are the result of actual differences in prevalence of the underlying constructs being assessed. For example, assessing the primary transportation mode to work in the past week does not include active transportation performed by respondents who are unemployed, who walk or bicycle to work occasionally, or who use active transportation to go to destinations other than work. Single-day records of trips or activities do not restrict respondents to only reporting work commuting and therefore are more likely to include a larger portion of active transportation behaviors than transportation to work assessments. However, at the population level, active transportation might be more common on some days of the week (e.g., weekends) and less so on other days. Because NHTS and ATUS weight their data to be equally representative of all days of the week, prevalence estimates might be lower than assessments that assess typical behavior across a longer time span, such as the behavioral assessments in NHANES and NHIS.

Trends Over Time

Despite the variety of assessments used, the results of this comparison can be useful to examine trends in active transportation over time. Among the systems with three or more assessment periods (ACS, ATUS, and NHANES), the prevalence of active transportation was relatively stable. In the 2006–2012 ACS, the prevalence of active transportation as the primary commute mode varied by one tenth of a percentage point, and for the period 2005–2012, no significant linear trend over time was detected (p = 0.06). During 2003–2012, ATUS data showed progressively higher active transportation during 2003–2006, after which levels fluctuated before decreasing in the last 3 years. Active transportation in 2012 was 10.5%, slightly lower than the 12.1% recorded for 2003. As with ACS, no significant linear trend over time was detected (p = 0.15).

A similar analysis of NHANES data is complicated by the 2007 assessment change. Before 2007, the prevalence was relatively stable, increasing from 24.1% in 1999–2000 to 26.6% in 2005–2006. This difference was small compared

TABLE 7. Percentage of respondents who reported ≥10 minutes of walking for transportation in the past week — National Health Interview Survey, United States, 2005 and 2010

	2005			2010		
Characteristic	**%**	**(95% CI)**	**p value**	**%**	**(95% CI)**	**p value**
Sex			p<0.001			p<0.001
Male	30.7	(29.6–31.8)		32.6	(31.4–33.7)	
Female	26.8	(25.8–27.9)		27.0	(26.0–28.1)	
Age group (yrs)			p<0.001			p<0.001
16–39	32.9	(31.6–34.2)		35.5	(34.1–36.9)	
40–59	28.4	(27.2–29.5)		28.2	(27.1–29.4)	
≥60	21.6	(20.4–22.9)		22.6	(21.4–23.8)	
Race/Ethnicity			p<0.001			p<0.001
White, non-Hispanic	27.5*	(26.4–28.5)		28.2*	(27.1–29.3)	
Black, non-Hispanic	31.4	(29.5–33.4)		31.4	(29.5–33.3)	
Other, non-Hispanic	33.3	(30.4–36.2)		34.4	(31.9–36.8)	
Hispanic	31.3	(29.6–33.1)		33.6	(31.7–35.6)	
Education			p<0.001			p<0.001
<High school	26.4	(24.7–28.0)		28.8	(27.1–30.6)	
High school or GED	23.2	(22.0–24.4)		24.2	(23.0–25.5)	
Some college	30.4	(29.0–31.8)		29.4	(28.1–30.7)	
College graduate	34.8†	(33.3–36.3)		35.6†	(34.2–37.0)	
Total	**28.7**	**(27.8–29.6)**		**29.7**	**(28.9–30.6)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate.
* Significantly different from other races/ethnicities (p<0.001, Wald chi-square test).
† Significantly different from other education groups combined (p<0.001, Wald chi-square test).

with the variance of the estimates (p = 0.14 for trend). In the three cycles after 2007, the prevalence was relatively stable in 2007–2008 (24.2%) and 2009–2010 (24.9%), after which it increased to 31.4% in 2011–2012. The reason for this increase is not clear. One possibility is cycle-to-cycle heterogeneity among the 15 locations included in NHANES cycles; however, this is speculative because location data are not publicly available. ACS and ATUS assessments from the same period do not show a comparable increase in related but distinct active transportation constructs. Although trend analysis in systems with only two assessment periods is tenuous, all three such assessments showed increases from cycle one to cycle two. Planned updates to NHTS and NHIS will help clarify whether these are actual trends.

Sex

Sex-stratified analyses resulted in inconsistent patterns across surveillance systems. In most years, men tended to report more active transportation than women in the transportation-to-work assessments (ACS and NHTS) and the behavioral assessments (NHANES and NHIS). This finding is similar to those from previous surveillance of leisure-time physical activity (*17*), which often indicate that men participate in more activity than women. Patterns of active transportation by sex in the single-day assessments were less consistent. The reasons for this are not readily explained by surveillance data. Single-day assessments might capture active transportation that women do not report through other assessment techniques; however, this hypothesis is speculative and has not been tested.

Age

Persons aged ≤39 years consistently participate in more active transportation than persons in other age groups, regardless of assessment type. Persons aged 40–59 years (the intermediate age group) reported less active transportation in ACS and NHTS transportation-to-work assessments than either the older or younger groups, whereas other assessments (that also assessed active transportation not related to work) suggested a progressive decrease in reported active transportation with increasing age. One potential explanation is what is referred to as the healthy worker effect; to be eligible to answer transportation-to-work questions (ACS and NHTS), a person must report being employed. However, this is not the case with other types of active transportation assessments. Adults aged ≥60 years who are still employed might be better able to participate in active transportation than their nonworking peers, which might skew results when compared with results from assessments that include both employed and unemployed participants.

Race/Ethnicity

Another consistent finding was the lower prevalence of active transportation among non-Hispanic whites compared with other racial/ethnic groups. Across 31 distinct assessments over time, non-Hispanic whites exhibited the lowest prevalence point estimate of active transportation in all but seven assessments (ACS: 2005, 2006, 2009, 2010, 2012; NHANES: 1999–2000 and 2001–2002). In all assessments over time, a group other than non-Hispanic whites exhibited the highest active transportation prevalence point estimate. This finding is consistent with previous analyses of NHTS and NHIS data that suggested minority populations were more likely to walk for transportation than non-Hispanic whites (*8*,*18*,*19*) and also is consistent with national estimates of accelerometer-estimated total physical activity from NHANES 2003–2004 (*10*). This contrasts with usual findings regarding leisure-time physical activity, during which non-Hispanic whites often report more leisure-time physical activity and less leisure-time inactivity than other racial/ethnic groups (*17*,*20*).

TABLE 8. Percentage of respondents who met 2008 *Physical Activity Guidelines for Americans* for aerobic activity* — National Health and Nutrition Examination Survey, National Health Interview Survey, United States, 1999–2012

	National Health and Nutrition Examination Survey														
	1999–2000†			2001–2002†			2003–2004†			2005–2006†			2007–2008		
Characteristic	%	(95% CI)	p value	%	(95% CI)	p value	%	(95% CI)	p value	%	(95% CI)	p value	%	(95% CI)	p value
Sex			p = 0.04			p = 0.02			p = 0.11			p = 0.10			p<0.001
Male	8.8	(6.8–10.7)		6.9	(5.4–8.5)		7.0	(4.5–9.5)		7.2	(6.0–8.5)		14.8	(12.2–17.3)	
Female	7.0	(4.5–9.6)		5.0	(3.8–6.3)		5.9	(3.8–8.0)		6.1	(4.5–7.7)		11.5	(9.0–14.0)	
Age group (yrs)			p = 0.005			p = 0.04						p<0.001			p<0.001
16–39	9.1§	(6.4–11.7)		7.0§	(5.6–8.5)		8.5§	(5.4–11.6)	p = 0.004	8.6§	(6.5–10.6)		16.9§	(13.4–20.4)	
40–59	6.1	(3.8–8.3)		4.8	(3.3–6.3)		4.9	(2.5–7.3)		5.1	(3.8–6.4)		11.4	(8.9–13.9)	
≥60	7.8	(5.9–9.6)		5.6	(3.6–7.5)		4.7	(2.7–6.6)		5.5	(4.0–7.0)		8.3	(6.7–10.0)	
Race/Ethnicity			p = 0.02			p = 0.02			p<0.001			p = 0.08			p = 0.02
White, non-Hispanic	6.8¶	(4.9–8.8)		5.3¶	(4.0–6.6)		5.0¶	(3.1–6.8)		5.9	(4.4–7.4)		11.5¶	(9.5–13.6)	
Black, non-Hispanic	11.2	(7.5–14.8)		8.0	(5.8–10.2)		9.8	(6.5–13.1)		8.7	(5.7–11.7)		11.9	(9.0–14.8)	
Other, non-Hispanic	12.3	(4.9–19.7)		5.5	(3.0–8.0)		12.1	(6.0–18.1)		8.6	(5.0–12.3)		17.5	(7.1–27.9)	
Hispanic	8.7	(6.6–10.8)		7.9	(5.6–10.3)		9.2	(6.4–11.9)		8.3	(6.2–10.5)		19.7	(14.8–24.7)	
Education			p = 0.02			p = 0.45			p = 0.16			p = 0.80			p<0.001
<High school	9.3**	(6.8–11.8)		6.8	(5.4–8.3)		8.1	(5.3–10.9)		7.5	(5.7–9.3)		18.0**	(13.6–22.4)	
High school or GED	5.5	(3.8–7.2)		5.4	(3.6–7.1)		6.3	(3.8–8.7)		6.2	(4.3–8.0)		10.0	(7.5–12.5)	
Some college	8.1	(5.4–10.8)		6.0	(4.3–7.7)		5.9	(3.0–8.8)		6.6	(4.4–8.8)		13.4	(10.0–16.8)	
College graduate	8.6	(5.2–11.9)		5.7	(4.4–7.0)		5.6	(3.7–7.5)		6.5	(4.3–8.7)		10.9	(8.2–13.5)	
Total	**7.9**	**(5.8–9.9)**		**6.0**	**(4.8–7.1)**		**6.4**	**(4.2–8.6)**		**6.6**	**(5.4–7.9)**		**13.0**	**(10.8–15.6)**	

See table footnotes on next page.

Education

Across all assessments and times, the highest point estimate for active transportation is found either among the most highly educated (4-year college degree or higher) or the least educated (less than high school) groups. This finding lends support to a potential nonmonotonic association between education and active transportation as suggested in other studies, including a recent analysis of ACS data (*8*,*21*,*22*). Factors contributing to this pattern cannot be definitively derived from these surveillance data but might be partially attributable to the direct association between education and socioeconomic status; low socioeconomic status might restrict private transportation options and increase reliance on walking and bicycling. In addition, urban areas tend to have both higher prevalence of active transportation and more residents with college degrees than rural areas: the 2012 ACS (*23*) suggests 31% of urban residents aged ≥25 years have at least a bachelor's degree, compared with only 20% of rural residents. Hence, the high prevalence of active transportation among educated respondents might be confounded by place of residence.

Population Density and Urbanicity

ACS and NHTS both provided the data needed for calculation of prevalence stratified by population density, whereas only NHTS provided the data needed for stratification by residential density and urbanicity. Regardless of assessment type or period, active transportation was highest in the most densely populated, urban areas. These findings are in agreement with those from numerous other studies. A recent systematic review of 20 cross-sectional and 13 quasiexperimental studies found that built environment features of urban areas, namely high land use mix, connectivity, and population density, were directly associated with physical activity, particularly walking for transportation (*5*).

Physical Activity Guidelines for Americans

As stated previously, the 2008 *Physical Activity Guidelines for Americans* do not recommend specific modes of activity; rather, they present a consensus on a volume of physical activity proven to be health enhancing. Active transportation is only one of several types of activity that could be used to meet this recommendation. In areas that are expanding environmental features supportive of active transportation (e.g., sidewalks, bicycle paths, and crossing signals), the prevalence of meeting guidelines through active transportation might be an important measure of population health impact, with relevance to health impact assessment and fostering community support. Only two systems collect the data needed to determine which respondents meet the aerobic physical activity guideline through active transportation. Based on estimates from NHANES and NHIS, this prevalence ranges from 4.7% (NHIS, 2010) to 18.0% (NHANES, 2011–2012). The change in assessment in NHANES 2007–2008 increased estimates nearly twofold and complicates interpretation of temporal trends. However, several consistencies in stratified analyses were noted. Men and persons aged ≤39 years often met guidelines more commonly than women and older age groups, respectively. This is similar to surveillance findings for leisure-time physical activity (*17*). However, in contrast with findings from leisure-time physical activity surveillance, non-Hispanic

TABLE 8. (*Continued*) Percentage of respondents who met 2008 *Physical Activity Guidelines for Americans* for aerobic activity* — National Health and Nutrition Examination Survey, National Health Interview Survey, United States, 1999–2012

	National Health and Nutrition Examination Survey						National Health Interview Survey					
	2009–2010			2011–2012			2005			2010		
Characteristic	%	(95% CI)	p value	%	(95% CI)	p value	%	(95% CI)	p value	%	(95% CI)	p value
Sex			p<0.001			p<0.001			p<0.001			p<0.001
Male	14.9	(12.8–17.0)		20.4	(16.9–23.9)		7.2	(6.6–7.7)		5.4	(4.9–5.9)	
Female	11.5	(9.2–13.8)		15.9	(12.2–19.5)		5.9	(5.4–6.3)		4.1	(3.6–4.5)	
Age group (yrs)			p<0.001			p<0.001			p<0.001			p = 0.003
16–39	16.7§	(13.7–19.6)		22.9§	(17.4–28.4)		7.4	(6.7–8.0)		5.4	(4.8–6.0)	
40–59	13.0	(10.1–15.8)		16.0	(12.7–19.4)		6.5	(5.9–7.1)		4.3	(3.8–4.9)	
≥60	7.1	(5.8–8.4)		12.9	(10.6–15.1)		4.8	(4.3–5.4)		4.1	(3.5–4.7)	
Race/Ethnicity			p<0.001			p = 0.18			p<0.001			p<0.001
White, non-Hispanic	11.2¶	(9.1–13.3)		16.7	(13.0–20.3)		5.8¶	(5.3–6.2)		4.2¶	(3.8–4.7)	
Black, non-Hispanic	18.3	(14.8–21.8)		20.9	(15.8–26.0)		7.3	(6.4–8.3)		5.1	(4.2–6.0)	
Other, non-Hispanic	16.6	(11.8–21.4)		21.4	(14.3–28.5)		8.0	(6.4–10.0)		5.5	(4.4–6.5)	
Hispanic	16.4	(11.3–21.5)		20.0	(14.5–25.5)		9.0	(8.0–10.0)		6.2	(5.5–6.9)	
Education			p<0.001			p = 0.14			p<0.001			p = 0.007
<High school	17.4**	(14.5–20.2)		19.6	(16.0–23.2)		7.3	(6.4–8.1)		4.7	(4.0–5.4)	
High school or GED	9.8	(7.6–11.9)		14.1	(10.2–18.1)		4.9**	(4.4–5.5)		4.1**	(3.5–4.7)	
Some college	13.3	(10.7–15.9)		19.8	(14.3–25.3)		7.2	(6.5–8.0)		4.5	(3.9–5.0)	
College graduate	12.1	(8.5–15.8)		17.8	(12.8–22.8)		6.9	(6.2–7.6)		5.4	(4.8–6.0)	
Total	**13.2**	**(11.2–15.4)**		**18.0**	**(14.6–21.5)**		**6.5**	**(6.1–6.9)**		**4.7**	**(4.3–5.0)**	

Abbreviations: CI = confidence interval; GED = General Education Development certificate; NHIS = National Health Interview Survey; NHANES = National Health and Nutrition Examination Survey.

* The top 99th percentile of weekly minutes of active travel were omitted from all estimates because of implausibly high values.

† The 1999–2006 NHANES cycles did not specify ≥10 minutes of active travel; therefore, "meeting guidelines" is an imperfect estimate.

§ Significantly different from other age groups combined (p = 0.01 for 1999–2000, p = 0.03 for 2001–2002, and p<0.001 for all years during 2003–2012, Wald chi-square tests).

¶ Significantly different from other races/ethnicities combined (p = 0.02 for 1999–2000, p = 0.02 for 2001–2002, p<0.001 for 2003–2004, p = 0.007 for 2007–2008, and p<0.001 for 2009–2010 and NHIS 2005 and 2010, Wald chi-square tests).

** Significantly different from other education groups combined (p = 0.01 for 1999–2000, p<0.001 for 2007–2008 and 2009–2010, p<0.001 for NHIS 2005, and p = 0.04 for NHIS 2010, Wald chi-square tests).

whites were less likely to meet aerobic guidelines through active transportation than other racial/ethnic groups, and the most educated group tended to meet guidelines through active transportation less frequently than less educated groups. Persons with college degrees often reported a relatively high prevalence of participating in any active transportation; however, results based on minutes per week suggest that the overall volume might be lower among this group than others.

Local-Level Data

States and local organizations use information on active transportation specific to their jurisdictions. Local-level data are particularly important for municipalities and metropolitan planning organizations, which often are responsible for building and maintaining pedestrian and bicycle infrastructure. Of the five systems considered in this report, only ACS and NHTS have publicly available data for geographic areas smaller than states. NHTS includes data for states and selected metropolitan statistical areas but suppresses city of residence for areas with <1 million residents (*24*). During NHTS planning, states and municipalities can purchase additional sample size from the U.S. Department of Transportation for use in local transportation planning efforts. ACS provides transportation-to-work data at the state, county, city, census-tract, and census block-group levels, although census-tract and block-group estimates require 3- or 5-year averages of ACS data. In addition, areas smaller than counties are only available through American FactFinder (http://factfinder.census.gov), which is an online analysis system administered by the U.S. Census Bureau. To protect anonymity, downloadable raw data tables with individual responses only identify participant locations at the PUMA level, which consist of clusters of census tracts with at least 100,000 residents. At the state level, ATUS can produce estimates through a linkage with the Current Population Survey, completion of which is a prerequisite for inclusion in the ATUS sample. NHANES and NHIS both restrict public-access geographic information to protect anonymity. NHIS provides data at the census region level (Midwest, Northeast, South, and West) and no lower. Both NHANES and NHIS collect more detailed geographic information; however, users must request permission and perform approved analyses at a research data center (*25*).

Counties and cities that choose to collect their own active transportation data should be cautious when making comparisons with these national estimates. Such comparisons are only appropriate if the exact assessment technique is used, and even then, subtle differences in wording or order might influence results (*26*).

Data Use and Applicability

Although different active transportation constructs yield widely discrepant prevalence estimates, because each represents a distinct concept, identifying the single best assessment type is not possible. Each has limitations and strengths and might be useful in different situations. For example, soliciting the primary past-week mode of travel to work eliminates the possibility of calculating activity volume and likely underestimates total active transportation prevalence because it ignores active transportation that is part of a multimode commute, performed infrequently, or performed for nonwork travel (*22*). As such, this surveillance method has low sensitivity for identifying persons who participate in any active transportation whatsoever. In contrast, for employed respondents, this method provides a clear definition of what is being requested and mutually exclusive and exhaustive response options. These factors might increase specificity by discouraging those who truly participate in no active transportation from selecting active transportation modes in their response. Such specific results might provide an estimate of regular, committed participants in active transportation. This information might be of interest to planners and engineers as they design infrastructure to support active transportation in populations.

Using assessments of a single day's trips or activities also has several limitations and strengths. First, because only 1 day is assessed per person, calculating weekly statistics of frequency or volume of activity is impossible, limiting the ability to assess compliance with activity guidelines. In other words, although estimates from these assessments might be considered "prevalence on a given day," no additional inference is possible. In addition, the content of logs for trips or activities might depend on a respondent's understanding of what constitutes a trip or activity. These factors are countered by strengths of the 1-day assessment, such as the ability to use a log (as in NHTS) or guided, conversational interviewing (as in ATUS). These techniques might provide greater validity than simple recall questionnaires but might also become time-consuming if multiple days are assessed. Furthermore, single-day trip logs often provide information on destination or purpose. Such details about the types of places that might attract active transportation users could be important to urban and transportation planners.

Finally, assessments of typical active transportation behaviors, such as the questionnaire items in NHANES and NHIS, also have unique limiting factors and strengths. First, these assessments might be somewhat complicated for the respondents if they are asked to recall instances of a routine behavior over multiple days, estimate the frequency and duration of that behavior, and filter those results so that they only include instances in which the activity was performed primarily for transportation purposes. These numerous steps increase the likelihood of inaccurate recall, which among other factors (*27*) contributes to generally low convergent validity compared with results from device-based activity monitors such as accelerometers (*28*). In contrast, using a recall period longer than a single day for assessments might increase the likelihood that infrequent active transportation is captured, which could yield higher sensitivity than the journey to work and single-day assessments described previously. In addition, including follow-up questions that assess frequency and duration of active transportation makes it possible to estimate physical activity volume attributable to active transportation and by extension allows classification relative to physical activity guidelines.

Limitations

The findings in this report are subject to at least three limitations. First, all are self-reported measures and subject to recall and social desirability biases. Second, survey questions and methods are subject to changes from year to year, limiting comparability across time. These might include changes to sampling and data collection strategies, such as inclusion of cellular telephone numbers (*29–31*) or changes to question wording as occurred in NHANES 2007–2008. Finally, inclusion and exclusion of questions about active transportation measures in periodic surveys vary. The comparability of results over time is contingent on repeated cycles of data collection, analysis, and dissemination.

Conclusion

Active transportation prevalence is assessed in various ways by five national surveillance systems. Differences in construct definition and assessment technique resulted in widely discrepant prevalence estimates. Trends in active transportation were inconsistent over time, although future updates to NHTS, NHIS, and NHANES will allow more complete trend analysis. Across systems, men often reported more active transportation than women, younger respondents tended to report more active transportation than older respondents, and non-Hispanic whites tended to report less active transportation than other racial/ethnic groups. Among education groups, the highest prevalence of active transportation was usually in the least or most educated groups. Active transportation was more prevalent in densely populated, urban areas. Certain persons likely perform sufficient active transportation to meet physical activity guidelines, although the relationship between active transportation and other areas of physical activity also is important. Finally, when using data from each surveillance system, the respective assessment technique should be considered in light of the system's strengths and limitations.

In the United States, urban areas are growing faster than nonurban areas (*32*). Given this trend and the higher prevalence of active transportation in densely populated areas mentioned previously, continued monitoring of the prevalence of active transportation across multiple measures and geographic scales by transportation and public health professionals is important. In addition, data that characterize who is performing active transportation in various contexts can help local officials properly plan active transportation infrastructure (e.g., sidewalks, pedestrian signals, and bicycle lanes) to meet any underlying demands. Finally, active transportation initiatives, such as Safe Routes to Schools (http://www.saferoutesinfo.org) and Complete Streets (http://www.smartgrowthamerica.org/complete-streets) are proliferating across the country. Active transportation surveillance data might be used to identify areas where these programs have had the greatest effect and identify best practices for others to follow.

References

1. Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee report. Washington, DC: US Department of Health and Human Services; 2008. Available at http://www.health.gov/paguidelines/report.
2. US Department of Health and Human Services. Healthy People 2020 topics and objectives: physical activity. Washington, DC: US Department of Health and Human Services; 2014. Available at http://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity.
3. CDC. Winnable battles. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at http://www.cdc.gov/winnablebattles.
4. CDC. Transportation health impact assessment toolkit. Atlanta, GA: US Department of Health and Human Services, CDC; 2011. Available at http://www.cdc.gov/healthyplaces/transportation/promote_strategy.htm.
5. McCormack GR, Shiell A. In search of causality: a systematic review of the relationship between the built environment and physical activity among adults. Int J Behav Nutr Phys Act 2011;8:125.
6. US Federal Highway Administration. Report to the U.S. Congress on the outcomes of the Nonmotorized Transportation Pilot Program: SAFETEA-LU Section 1807. Washington, DC: US Department of Transportation; 2012. Available at http://www.fhwa.dot.gov/environment/bicycle_pedestrian/ntpp/2012_report/page01.cfm.
7. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U; Lancet Physical Activity Series Working Group. Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet 2012;380:247–57.
8. Pucher J, Buehler R, Merom D, Bauman A. Walking and cycling in the United States, 2001–2009: evidence from the National Household Travel Surveys. Am J Public Health 2011;101(Suppl 1):S310–7.
9. US Census Bureau. Public use microdata areas (PUMAs). Washington, DC: US Census Bureau; 2014. Available at http://www.census.gov/geo/reference/puma.html.
10. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc 2008;40:181–8.
11. US Census Bureau. Employment status, table S2301. Washington, DC: US Census Bureau; 2013. Available at http://factfinder.census.gov.
12. Alliance for Biking and Walking. Bicycling and walking in the United States. 2014 benchmarking report. Washington DC: Alliance for Biking and Walking; 2014. Available at https://www.bikewalkalliance.org/storage/documents/reports/2014BenchmarkingReport.pdf.
13. University of Missouri Data Center. MABLE/Geocorr12: Geographic Correspondence Engine. Columbia, MO: University of Missouri Data Center; 2012. Available at http://mcdc.missouri.edu/websas/geocorr12.html.
14. US Department of Transportation, National Household Travel Survey. Tract and block group variables (also known as Claritas variables). Washington, DC: US Department of Transportation; 2009. Available at http://nhts.ornl.gov/2009/pub/UsersGuideClaritas.pdf.
15. US Department of Health and Human Services. Physical activity guidelines for Americans. Washington, DC: US Department of Health and Human Services; 2008. Available at http://www.health.gov/PAGuidelines/guidelines/.
16. Rao JNK, Scott AJ. On chi-squared tests for multiway contingency-tables with cell proportions estimated from survey data. Ann Stat 1984;12:46–60.
17. Carlson SA, Densmore D, Fulton JE, Yore MM, Kohl HW 3rd. Differences in physical activity prevalence and trends from 3 U.S. surveillance systems: NHIS, NHANES, and BRFSS. J Phys Act Health 2009;6(Suppl 1):S18–27.
18. Kruger J, Ham SA, Berrigan D, Ballard-Barbash R. Prevalence of transportation and leisure walking among U.S. adults. Prev Med 2008; 47:329–34.
19. Paul P, Carlson SA, Carroll DD, Berrigan D, Fulton JE. Walking for transportation and leisure among U.S. adults—National Health Interview Survey 2010. J Phys Act Health 2015;12(Suppl 1):S62–9.
20. CDC. Trends in leisure-time physical inactivity by age, sex, and race/ethnicity—United States, 1994–2004. MMWR Morb Mortal Wkly Rep 2005;54:991–4.
21. Ham SA, Macera CA, Lindley C. Trends in walking for transportation in the United States, 1995 and 2001. Prev Chronic Dis 2005;2:A14.
22. McKenzie B. Modes less traveled—bicycling & walking to work in the U.S.: 2008–2012. Washington, DC: US Census Bureau; 2014. Available at https://www.census.gov/prod/2014pubs/acs-25.pdf.
23. US Census Bureau. Percent of people 25 years and over who have completed a bachelor's degree. Table GCT1502. Washington, DC: US Census Bureau; 2013. Available at http://factfinder.census.gov.
24. United States Federal Highway Administration. 2009 NHTS Codebook. Washington DC: United States Department of Transportation; 2009.
25. CDC. NCHS Research Data Center. US Department of Health and Human Services, CDC; 2009. Available at http://www.cdc.gov/rdc/index.htm.
26. McClain JJ, Grant D, Willis G, Berrigan D. Effect of temporal domain on self-reported walking behaviors in the California Health Interview Survey. J Phys Act Health 2012;9:344–51.
27. Pettee Gabriel KK, Morrow JR Jr, Woolsey AL. Framework for physical activity as a complex and multidimensional behavior. J Phys Act Health 2012;9(Suppl 1):S11–8.
28. van Poppel MN, Chinapaw MJ, Mokkink LB, van Mechelen W, Terwee CB. Physical activity questionnaires for adults: a systematic review of measurement properties. Sports Med 2010;40:565–600.
29. Blumberg SJ, Luke JV. Wireless substitution: early release of estimates from the National Health Interview Survey, July–December 2013. Hyattsville, MD: CDC, National Center for Health Statistics; 2014. Available at http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201407.pdf.
30. CDC. Overview: BRFSS 2011. Atlanta, GA: US Department of Health and Human Services, CDC; 2011. Available at http://www.cdc.gov/brfss/annual_data/2011/pdf/overview_11.pdf.
31. US Federal Highway Administration. 2009 National Household Travel Survey user's guide. Washington, DC: US Department of Transportation; 2009.
32. US Census Bureau. Growth in urban population outpaces rest of nation. Release CB12-50. Washington, DC: US Census Bureau; 2012. Available at http://www.census.gov/2010census/news/releases/operations/cb12-50.html.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format. To receive an electronic copy each week, visit *MMWR*'s free subscription page at http://www.cdc.gov/mmwr/mmwrsubscribe.html. Paper copy subscriptions are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone 202-512-1800.

Readers who have difficulty accessing this PDF file may access the HTML file at http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6407a1.htm?s_cid=ss6407a1_w. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Executive Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to mmwrq@cdc.gov.

ISSN: 1546-0738