Physical activity patterns among walkers and compliance with public health recommendations

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ABSTRACT

RAFFERTY, A. P., M. J. REEVES, H. B. MCGEE, and J. M. PIVARNIK. Physical activity patterns among walkers and compliance with public health recommendations. *Med. Sci. Sports Exerc.*, Vol. 34, No. 8, pp. 1255–1261, 2002. **Purpose:** Walking is the most common leisure-time physical activity (LTPA) among U.S. adults. The purpose of this study was to estimate the prevalence of walking for physical activity and the proportion of walkers who met current public health physical activity recommendations. **Methods:** We analyzed data from the 1998 Behavioral Risk Factor Surveillance System, a collection of state-based, random-digit-dialed telephone surveys of adults. Physical activity measures included the type, frequency, and duration of the two LTPAs in which respondents engaged most often during the previous month. We calculated the prevalence of walking and the prevalence of three physical activity patterns defined by combinations of walking duration and frequency. We also examined the effect on these patterns of participating in a second LTPA. **Results:** In 1998, an estimated 38.6% of U.S. adults walked for physical activity. Among walkers, 21.3% walked a minimum of 30 min five or more times per week. This approximates compliance with current physical activity recommendations. Compliance increased to 34.5% when the criteria were relaxed to include at least 150 min of walking per week accumulated over three or more occasions. Relaxing the criteria further to include a minimum of 150 min·wk^{-1} regardless of frequency produced only a small increase in compliance (37.6%). However, compliance with each of these three activity patterns approximately doubled when a second LTPA was taken into account. **Conclusions:** Less than 40% of walkers complied through walking with even our most liberal physical activity pattern ($\geq$150 min·wk^{-1} regardless of frequency). For walkers to meet current public health recommendations, many need to walk more frequently and/or to engage in additional physical activities. **Key Words:** PHYSICAL ACTIVITY, WALKING, EPIDEMIOLOGY, HEALTH SURVEYS

Promotion of physical activity to reduce the burden from chronic diseases such as coronary heart disease, hypertension, colon cancer, and diabetes, is a public health priority (25). In 1996, the office of the Surgeon General released a landmark report, *Physical Activity and Health* (26), which concluded that significant health benefits could be achieved by engaging in moderate amounts of physical activity (such as 30 min of brisk walking) on most, if not all, days of the week. This report was in general agreement with other public health recommendations (13,15) as well as national health objectives (24,25).

The Surgeon General's report suggested that even modest increases in daily physical activities could improve the health and quality of life for most people. The report clarified that a moderate amount of physical activity could be accumulated in many ways, e.g., through longer sessions of lower-intensity physical activity, through several 10-min sessions of moderate-intensity activities throughout the day, as well as through a single 30-min moderate-intensity session (26). Given this broad approach taken by the Surgeon General's report, the optimal population-based indicator that measures compliance with current public health physical activity recommendations (15,26) has not been established. For the past several years, a standard physical activity indicator used by the Behavioral Risk Factor Surveillance System (BRFSS) has been defined as engaging in at least 30 min of any leisure-time physical activity (LTPA), regardless of intensity, five or more times per week, which was based on Healthy People 2000 objective 1.3 (24). Other definitions designed to measure how well adults meet public health recommendations have included the proportion of adults who obtained 150 min of moderate LTPA per week through five or more sessions (8,16), as well as the proportion who accumulated 4184 kJ·wk^{-1} from LTPA (8).

Walking is the most common type of LTPA among all U.S. adults (17,23), as well as among older adults (30) and overweight adults trying to lose weight (27). Over half of

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the respondents to the 1990 BRFSS who engaged in any LTPA reported walking (23). The acceptability and accessibility of walking is highlighted by the fact that lower-income, older, and obese persons, who are less likely to engage in LTPA, were about as likely as the general population to report that they walked for physical activity (17,23). Regular participation in walking has been shown to decrease all-cause mortality (5,19) and reduce the risk of coronary heart disease (4,10–12), stroke (7), and type 2 diabetes (6). Several prospective analyses have demonstrated a clear dose-response relationship between metabolic equivalent task-hours (MET-hours) of walking and lower disease risk (6,7,12), as well as between intensity of walking and risk reduction (6,12), indicating that there is a continuum of benefit from increasing levels of walking. The benefits of increased physical activity, especially from a moderate-intensity LTPA such as walking, are thought to outweigh the risk of adverse effects, such as musculoskeletal injuries or cardiac events, especially if individuals do not engage in LTPAs well beyond their normal level of exertion (26).

Our previous investigation of compliance with public health physical activity recommendations among Michigan walkers, found that frequency of walking was a more limiting factor than duration (17). Several epidemiologic studies have, however, found an association between walking and positive health outcomes using walking duration or MET-hours, without specific regard to frequency (6,7,10–12,19). Therefore, we decided to examine the prevalence of three physical activity patterns with different levels of walking frequency.

The objectives of our study were: 1) to determine the prevalence of walking for physical activity among U.S. adults by demographic and health-related characteristics; 2) to assess the proportion of walkers who followed the recommendation to obtain 30 min of moderate physical activity on most days of the week, through walking; 3) to assess the effect on compliance of varying the frequency criterion of the walking patterns; and 4) to assess the effect of engaging in an additional physical activity on the prevalence of these physical activity patterns.

METHODS

The BRFSS is an ongoing surveillance system composed of annual, population-based, telephone surveys conducted by state health departments in cooperation with the Centers for Disease Control and Prevention. Each state-level survey uses random-digit-dialing methods to select sample phone numbers, and within each eligible household one adult aged 18 yr or older is randomly selected to be interviewed. The BRFSS is conducted across the calendar year, either monthly or quarterly, using a standardized survey instrument. The median cooperation rate (number of completed interviews divided by the number of contacted households with a resident aged 18 yr or older) of the state-specific surveys in 1998 was 63.5%, with a range of 38.3% to 83.6%. Further details on the survey protocol are available elsewhere (18).

The 1998 BRFSS included questions on the two LTPAs that the respondent spent the most time doing during the past month while not at work. The first question asked was "During the past month, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" Follow-up questions were asked about the type, and the usual distance, frequency, and duration of the respondents' two predominant activities. To describe the prevalence of walking, all respondents who reported walking as either their first or second LTPA were classified as "walkers." Walkers were further classified into two subcategories: "only-walkers," i.e., those who reported walking as their only LTPA, and "walkers-plus," i.e., those who reported walking and another LTPA.

Three physical activity patterns based on duration and frequency of activity were defined. The first (pattern 1) most closely reflected current public health physical activity recommendations (i.e., 30 min of moderate activity on most days of the week) and the second two patterns (2 and 3) reflected increasing flexibility, especially in terms of the weekly frequency of activity. These patterns were not mutually exclusive. Pattern 1: at least 30 min per session five or more times per week ($\geq$30 min, $\geq$5 times per week); pattern 2: a total of at least 150 min·wk^{-1} accumulated over three or more sessions per week ($\geq$150 min·wk^{-1}, $\geq$3 times per week); and pattern 3: a total of at least 150 min·wk^{-1} regardless of frequency ($\geq$150 min·wk^{-1}).

The prevalence of walking and of the physical activity patterns through walking were examined by age, sex, race or ethnicity, education, household income, self-reported general health status, and weight status based on body mass index (BMI). BMI was calculated by dividing self-reported body weight in kilograms by self-reported height in meters squared. Overweight was defined as a BMI of equal to or greater than 25 kg·m^{-2} but less than 30 kg·m^{-2}; obese was defined as equal to or greater than 30 kg·m^{-2} (14).

We pooled 1998 BRFSS data from all 50 states and the District of Columbia for this analysis (N = 146,993). We excluded respondents who had not answered any of the physical activity questions and those who reported that they had done some physical activity but did not report the type of LTPA they had done (N = 1649). Excluded respondents were demographically similar to those included.

To account for weighting and complex sampling design, SUDAAN (22) was used to calculate all estimates and 95% confidence intervals. We chose not to report any statistical testing results because the very large sample sizes made most observed differences statistically significant. Instead, we have provided 95% confidence intervals for the prevalence estimates as a measure of precision.

RESULTS

The prevalence of walking from the 1998 BRFSS was 38.6% (Table 1). The prevalence of walking increased with age up until 65–74 yr (from 26.8% among 18- to 24-yr-olds to 45.5% among those aged 65–74 yr), was higher among women than men (46.5% vs 30.0%), was higher among

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TABLE 1. Prevalence of walking[a] for physical activity and the proportion who only walked.[b]

Characteristics	N[c]	Prevalence of Walking		Proportion Who Only Walked	
		%	95% CI[d]	%	95% CI
Total	145,344	38.6	38.2–39.0	57.6	57.0–58.2
Age (yr)					
18–24	12,803	26.8	25.6–28.0	56.6	54.1–59.1
25–34	27,237	33.9	33.0–34.8	55.5	53.9–57.1
35–44	32,848	38.6	37.8–39.4	55.2	53.8–56.6
45–54	26,048	43.8	42.8–44.8	57.6	56.1–59.1
55–64	17,430	45.3	44.1–46.5	60.1	58.3–61.9
65–74	15,969	45.5	44.3–46.7	59.5	57.7–61.3
≥75	12,419	37.4	36.0–38.8	63.1	60.8–65.4
Sex					
Male	59,561	30.0	29.4–30.6	55.5	54.3–56.7
Female	85,783	46.5	46.0–47.0	58.9	58.1–59.7
Race or ethnicity					
White	117,681	40.4	40.0–40.8	55.7	55.0–56.4
Black	12,193	36.0	34.7–37.3	67.1	64.9–69.3
Hispanic	9,397	29.4	28.0–30.8	64.8	62.1–67.5
Other	5,388	34.7	32.2–37.2	58.9	54.5–63.3
Education					
<High school	18,160	29.6	28.5–30.7	74.0	72.2–75.8
High school	47,845	37.3	36.6–38.0	63.2	62.1–64.3
Some college	39,936	40.0	39.2–40.8	54.7	53.5–55.9
College graduate	39,017	43.4	42.6–44.2	48.6	47.4–49.8
Household income					
<$20,000	28,171	35.7	34.7–36.7	67.3	65.8–68.8
$20,000–34,999	36,864	37.4	36.6–38.2	59.8	58.5–61.1
$35,000–49,999	24,540	40.0	39.0–41.0	54.5	53.0–56.0
≥$50,000	34,096	42.1	41.3–42.9	48.5	47.2–49.8
General health					
Excellent	34,024	38.1	37.3–38.9	51.0	49.6–52.4
Very good	48,782	41.1	40.4–41.8	54.7	53.6–55.8
Good	40,615	39.2	38.4–40.0	61.0	59.8–62.2
Fair	15,531	35.0	33.8–36.2	68.7	66.7–70.7
Poor	6,074	26.6	24.8–28.4	76.9	73.6–80.2
Weight status[e]					
Not overweight	64,807	38.5	37.9–39.1	53.8	52.8–54.8
Overweight	49,265	38.4	37.7–39.1	58.0	56.9–59.1
Obese	25,564	39.1	38.1–40.1	64.0	62.5–65.5

[a] Proportion of all respondents who reported walking as their first or second LTPA.
[b] Proportion of all walkers who reported walking as their only LTPA.
[c] Unweighted total sample size and sample size by subgroup.
[d] 95% confidence intervals; a conservative rule of thumb for evaluating pairwise differences is that if the confidence intervals do not overlap, the pairwise difference would probably be statistically significantly different.
[e] Not overweight was defined as BMI < 25, overweight as $25 \leq$ BMI < 30, and obese as BMI ≥ 30.

whites compared with other race/ethnic groups, and increased consistently with both increasing levels of education and household income. The prevalence of walking was lower among those in fair or poor health but was similar across categories of weight status.

The majority (57.6%) of walkers reported walking as their only LTPA (only-walkers) (Table 1). The proportion of only-walkers was higher among older adults and women. Blacks and Hispanics had a higher proportion of only-walkers than whites (67.1% and 64.8%, respectively, vs 55.7%). The proportion of only-walkers decreased with increasing education and income, and increased with deteriorating health and with increasing weight status (Table 1).

The median duration of a walking session reported among all walkers was 34.5 min (Table 2). The distribution of duration was highly skewed to the right (25th percentile 29.1 min, 75th percentile 59.3 min). The median walking duration decreased with age (from 40.2 min for 18- to 24-yr-olds to 28.5 min for those aged 75 yr or older), was higher among men than women, lower among whites compared with other race-ethnic groups, increased with increasing education and household income, and decreased with declining health status. The median frequency of walking was 2.9 times per week (Table 2). The distribution of walking frequency was also skewed to the right (25th percentile 1.8 times, 75th percentile 4.8 times). The median frequency for older walkers was one time per week more than for younger walkers (3.8 times for those aged 75 yr or older vs 2.8 times for 18- to 24-yr-olds). However, there was little variation in the median walking frequency across other demographic and health-related variables.

The prevalence of physical activity pattern 1 (≥30 min, ≥5 times per week) through walking was 21.3% (Table 3). When pattern 1 was modified to include those who walked for a total of at least 150 min·wk^{-1} accumulated over five or more sessions, the prevalence (22.2%) remained very similar to that of pattern 1. Results from this modification were not included in Table 3 because the estimates for these two patterns were so similar. Reducing the frequency criterion to 3 times per week resulted in a dramatic increase in the prevalence to 34.5% (pattern 2). However, the prevalence of pattern 3 (≥150 min·wk^{-1}) was 37.6%, indicating that removing the frequency criterion altogether resulted in only a slight increase in the prevalence beyond that of

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TABLE 2. Distribution of walking duration and frequency, among all walkers.

Characteristics	Walking Duration (min/session)			Walking Frequency (times/week)		
	Percentiles			Percentiles		
	25	50	75	25	50	75
Total	29.1	34.5	59.3	1.8	2.9	4.8
Age (yr)						
18–24	26.0	40.2	59.6	1.8	2.8	4.0
25–34	29.2	37.4	57.1	1.8	2.8	3.9
35–44	29.2	39.5	59.4	1.8	2.8	4.0
45–54	28.3	37.5	59.2	1.8	2.8	4.8
55–64	29.1	30.0	59.1	1.9	2.9	4.8
65–74	28.1	29.8	55.2	2.0	3.0	5.8
≥75	19.9	28.5	45.0	1.9	3.8	6.5
Sex						
Male	29.1	39.2	59.5	1.8	2.9	4.9
Female	29.1	30.0	59.2	1.8	2.9	4.8
Race or ethnicity						
White	29.1	30.0	59.2	1.8	2.9	4.8
Black	28.5	40.3	59.6	1.8	2.9	4.7
Hispanic	26.3	43.3	59.6	1.8	2.7	4.8
Other	26.1	38.2	57.2	1.8	2.8	4.7
Education						
<High school	28.2	29.9	59.5	1.8	2.9	5.0
High school	29.1	34.5	58.1	1.8	2.9	4.7
Some college	28.2	34.4	59.3	1.8	2.9	4.6
College graduate	29.2	34.7	59.1	1.8	2.9	4.8
Household income						
<$20,000	28.2	32.6	57.5	1.8	2.9	5.0
$20,000–34,999	29.1	34.3	59.4	1.8	2.9	4.7
$35,000–49,999	29.1	34.5	59.2	1.8	2.9	4.5
≥$50,000	29.2	39.1	59.2	1.8	2.9	4.8
General health						
Excellent	29.3	39.0	59.3	1.9	2.9	4.8
Very good	29.2	35.0	59.3	1.8	2.9	4.5
Good	28.2	34.0	59.3	1.8	2.9	4.7
Fair	24.5	29.6	56.1	1.8	2.9	4.9
Poor	18.4	27.5	44.3	1.8	2.9	5.7
Weight status[a]						
Not overweight	29.2	34.9	59.3	1.8	2.9	4.9
Overweight	29.2	39.1	57.9	1.8	2.9	4.8
Obese	28.1	29.8	59.3	1.8	2.8	4.5

[a] Not overweight was defined as BMI < 25, overweight was $25 \leq$ BMI < 30, and obese as BMI ≥ 30.

pattern 2. All three walking-related activity patterns showed similar relationships with the demographic and health-related variables. The prevalence estimates tended to increase with age, were higher among men than women, lower among those who were obese, and decreased with increasing levels of education and income.

When these data were analyzed with respect to the total survey population (which included the 61.4% who did not report walking as a LTPA), we estimated that 8.1% of all adults walked for at least 30 min five or more times per week (pattern 1), 12.9% walked for a total of at least 150 $\text{min}\cdot\text{wk}^{-1}$ accumulated over three or more sessions (pattern 2), and 13.9% walked a total of 150 min or more per week regardless of frequency (pattern 3) (data not shown).

The prevalence estimates for the physical activity patterns through walking are presented in Table 4 by walking subgroup, i.e., only-walkers and walkers-plus. The prevalence of pattern 1 was nearly identical among the only-walkers and walkers-plus groups (21.4% vs 21.2%), whereas the prevalence of patterns 2 and 3 were slightly lower among the only-walkers than among walkers-plus (33.5% vs 35.9%; 36.6% vs 39.0%).

The effect of engaging in a second LTPA on compliance through both activities is also shown in Table 4. Among the 42.4% of all walkers who engaged in a second LTPA (walkers-plus), the prevalence of each activity pattern approximately doubled when both walking and the other LTPA were taken into account. Among walkers-plus, gardening was the other activity most frequently reported (19.2%), followed by bicycling (8.1%), weight lifting (7.5%), aerobics (6.9%), and golf (6.9%) (data not shown). Most (68.8%) of these walkers-plus reported walking as their first LTPA (data not shown). The median duration of sessions for the second LTPA was 59.4 min and the median frequency was 1.9 times per week (data not shown).

DISCUSSION

We estimated that nearly 4 in 10 U.S. adults walked for exercise in 1998, and that for most walkers (57.6%), this was their only LTPA. The prevalence of walking in this analysis (38.6%) was similar to that reported from the 1990 BRFSS (35.6%) (23) and from the 1991 National Health Interview Survey (44.1%) (26). The demographic relationships that we observed in our study were also similar to those reported previously (23). The prevalence of walking increased with age up through middle age. Women showed a greater reliance on walking than men, with both a higher prevalence of walking and a higher proportion who reported that walking was their only LTPA. The prevalence of walking was higher among whites than blacks or Hispanics, but higher proportions of blacks and Hispanics relied on walk-

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TABLE 3. Prevalence of three physical activity patterns from walking, among all walkers.

Characteristics	Pattern 1[a] (≥30 min, ≥5 times/wk)		Pattern 2[b] (≥150 min·wk^{-1}, ≥3 times/wk)		Pattern 3[c] (≥150 min·wk^{-1})	
	Prevalence (%)	95% CI	Prevalence (%)	95% CI	Prevalence (%)	95% CI
Total	21.3	20.8–21.8	34.5	33.9–35.1	37.6	36.9–38.3
Age (yr)						
18–24	16.6	14.8–18.4	31.2	28.9–33.5	35.8	33.3–38.3
25–34	16.7	15.5–17.9	30.8	29.2–32.4	34.1	32.5–35.7
35–44	18.4	17.3–19.5	32.3	31.0–33.6	35.7	34.3–37.1
45–54	21.0	19.7–22.3	34.7	33.2–36.2	37.6	36.1–39.1
55–64	25.2	23.6–26.8	37.1	35.3–38.9	39.5	37.7–41.3
65–74	28.5	26.8–30.2	41.1	39.2–43.0	43.3	41.4–45.2
≥75	29.0	26.8–31.2	38.0	35.5–40.5	41.4	38.9–43.9
Sex						
Male	23.5	22.5–24.5	36.2	35.0–37.4	40.2	39.0–41.4
Female	20.0	19.4–20.6	33.5	32.7–34.3	36.1	35.3–36.9
Race or ethnicity						
White	21.4	20.8–22.0	34.2	33.5–34.9	37.0	36.3–37.7
Black	20.7	18.8–22.6	35.7	33.3–38.1	40.0	37.5–42.5
Hispanic	20.9	18.6–23.2	35.8	33.0–38.6	40.0	37.2–42.8
Other	22.0	17.7–26.3	36.2	31.5–40.9	39.3	34.5–44.1
Education						
<High school	24.9	23.0–26.8	36.4	34.2–38.6	40.6	38.3–42.9
High school	22.4	21.4–23.4	35.2	34.0–36.4	38.7	37.5–39.9
Some college	20.5	19.5–21.5	34.1	32.9–35.3	37.2	36.0–38.4
College graduate	19.9	18.9–20.9	33.7	32.6–34.8	36.0	34.8–37.2
Household income						
<$20,000	24.9	23.4–26.4	37.2	35.5–38.9	40.8	39.0–42.6
$20,000–34,999	21.3	20.2–22.4	34.0	32.7–35.3	37.3	35.9–38.7
$35,000–49,999	19.3	18.1–20.5	33.4	31.9–34.9	36.5	35.0–38.0
≥$50,000	20.0	19.0–21.0	34.0	32.8–35.2	36.5	35.3–37.7
General health						
Excellent	23.1	21.9–24.3	37.7	36.3–39.1	40.2	38.8–41.6
Very good	19.3	18.5–20.1	32.9	31.9–33.9	35.6	34.5–36.7
Good	21.3	20.2–22.4	34.1	32.8–35.4	38.1	36.8–39.4
Fair	23.7	21.8–25.6	34.6	32.5–36.7	37.5	35.3–39.7
Poor	23.5	19.8–27.2	32.6	28.3–36.9	35.6	31.2–40.0
Body mass index[d]						
Not overweight	22.6	21.8–23.4	36.1	35.1–37.1	38.9	37.9–39.9
Overweight	21.5	20.5–22.5	34.9	33.8–36.0	38.1	36.9–39.3
Obese	18.2	17.0–19.4	30.4	28.9–31.9	33.9	32.3–35.5

[a] Proportion of all walkers who walked for at least 30 min per walking session five or more times per week.
[b] Proportion of all walkers who walked three or more times per week for a total of at least 150 min·wk^{-1}.
[c] Proportion of all walkers who walked for a total of at least 150 min·wk^{-1} regardless of frequency.
[d] Not overweight was defined as BMI $<$ 25, overweight as 25 $\leq$ BMI $<$ 30, and obese as BMI $\geq$ 30.

ing as their only LTPA. Similarly, the prevalence of walking increased with increasing education and income; however, among walkers, the prevalence of only-walking decreased with increasing education and income. The increasing prevalence of walking with higher socioeconomic status may reflect greater availability of time and safer neighborhoods in which to walk, as well as perhaps being more informed on the health benefits of physical activity. The decreasing reliance on only-walking with increasing socioeconomic status probably reflects greater access to other activities because of both greater financial and time resources among higher socioeconomic groups. Lack of time, motivation, and energy have been cited by previous studies as barriers to exercise (2,9). King et al. (9) also found that a lack of a safe place to exercise was a commonly reported barrier for African-American women. Continued research on the barriers to walking, and other LTPA, is crucial to effectively helping people increase their physical activity.

Only one in five walkers usually walked five or more times per week for either at least 30 min per session or 150 min·wk^{-1}. These patterns approximate the current public health recommendation to obtain at least 30 min of moderate

TABLE 4. Prevalence of three physical activity patterns from walking, by walking subgroup, and from walking plus another leisure-time physical activity (LTPA).

Characteristics	Pattern 1[a] (≥30 min, ≥5 times/wk)		Pattern 2[b] (≥150 min·wk^{-1}, ≥3 times/wk)		Pattern 3[c] (≥150 min·wk^{-1})	
	Prevalence	95% CI	Prevalence	95% CI	Prevalence	95% CI
Activity from walking						
Walkers-only[d]	21.4	20.7–22.1	33.5	32.6–34.4	36.6	35.7–37.5
Walkers-plus[e]	21.2	20.4–22.0	35.9	34.9–36.9	39.0	38.0–40.0
Activity from walking plus another LTPA						
Walkers-plus	45.8	44.8–46.8	73.2	72.3–74.1	78.4	77.6–79.2

[a] Proportion of all walkers who walked for at least 30 min per walking session five or more times per week.
[b] Proportion of all walkers who walked three or more times per week for a total of at least 150 min·wk^{-1}.
[c] Proportion of all walkers who walked for a total of at least 150 min·wk^{-1} regardless of frequency.
[d] Reported walking as their only LTPA.
[e] Reported walking and another LTPA.

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activity on most days of the week. However, when the frequency criterion was lowered to three or more times per week, the prevalence increased by over 50%. Discarding the frequency criterion altogether resulted in only a very modest further increase in prevalence. So, even using our most liberal physical activity pattern, with no minimum frequency requirement, fewer than 4 in 10 walkers obtained 150 min of physical activity per week through walking.

The proportion of walkers in this study who were found to meet current physical activity recommendations through their walking was similar to that reported in previous population-based studies, even though these studies addressed moderate LTPA and used different definitions. Using 1996 BRFSS data, Pratt et al. (16) estimated that 23.4% of adults participated in moderate LTPAs (vigorous activities not included) at least five times per week for a total of 150 min or more. Using 1990 National Health Interview Survey data, Jones et al. (8) estimated that 32% of adults (without activity limitations or disabilities) engaged in moderate LTPAs (vigorous activities not included) at least 10 times over a 2-wk period for a total of 300 min or more and that 37.9% accumulated at least 4184 kJ of energy expenditure per week. These comparisons, although useful, point to the need to identify the most appropriate indicators of adequate adult physical activity that could be used consistently for public health surveillance, and to identify the necessary data collection methods that would obtain information on the accumulation of activities across the day and their respective intensities.

Some of the demographic relationships among compliance estimates that we observed among walkers, however, differ from those reported previously for moderate LTPA in the general population. For example, both Pratt et al. (16) and Jones et al. (8) found that the percent meeting recommendations for moderate physical activity increased with education and income and that whites tended to have higher levels of compliance as compared with blacks or Hispanics. However, in our study, compliance with physical activity recommendations among walkers, only through their walking, decreased with education and income, and tended to be similar across race-ethnicity groups. These differences may in part be explained by the fact that these estimates of compliance were limited to walkers and to the activity of walking, and by definition, excluded individuals who did no LTPA and did not take into account other LTPAs. These differences also highlight the fact that walkers are a distinct subpopulation with characteristics that differ from the general adult population.

There are several limitations to this study. First, these data were self-reported and may include reporting error related to the respondents' estimation and recall. Second, total physical activity would tend to be underestimated because nonleisure-time physical activities, such as those carried out as part of job duties or as part of day-to-day living, were not measured. Third, information was collected on only two types of LTPA. This could also contribute to the underestimation of total physical activity and of walking. The lack of information on both additional LTPAs and nonleisure-time activities limit our ability to measure accumulated physical activity across the day. Fourth, information was not collected specifically on the intensity of the LTPAs. Some walkers may have walked with less than moderate intensity, on both a relative and an absolute scale, which would tend to overestimate the proportion following recommendations. These data were also limited by the coverage- and nonresponse-related errors that affect all telephone surveys.

The strength of this study lies in the large sample size and the representativeness of the BRFSS data. We were able to look specifically at the activity patterns among walkers to assess how compliant this group was in following physical activity recommendations. Our results should be particularly useful in formulating interventions focused on individuals who already walk but are not attaining adequate levels of physical activity. The results of this study indicate two ways that walkers could be encouraged to attain a higher level of physical activity. 1) Walkers could increase the frequency of their walking sessions. Most walkers walked for at least 30 min at a time, but for fewer than three times per week. Because walking duration did not decrease with increased walking frequency (data not shown), increasing the frequency should result in increased total walking activity. 2) Our results also showed that engaging in a second LTPA was a very effective means to achieve recommended levels of physical activity. The prevalence estimates of the physical activity patterns through walking were similar among only-walkers and walkers-plus, indicating that physical activity levels from walking appear to be independent of whether another LTPA was done. When another LTPA was done in addition to walking, the prevalence of all physical activity patterns increased dramatically.

The high prevalence of walking, together with the low prevalence of compliance with current physical activity recommendations through walking found in this study, indicate that an important public health opportunity exists to increase adult physical activity. Newer approaches to increasing physical activity include the use of a "lifestyle approach" in which people incorporate moderate-intensity physical activities into their daily routines (1,3). This approach may have benefits similar to those of a more structured approach and may be a useful way for some people to incorporate additional physical activity, including walking, into their lives. Environmental and policy approaches to increasing the opportunity for safe, convenient, and enjoyable physical activity are also gaining attention (20,21). Examples would include activities such as posting signs encouraging the use of the stairs, providing fitness facilities at work sites, increasing the number of communities with sidewalks, and building more community bike and walking trails. In terms of more traditional approaches, the U.S. Preventive Services Task Force recommends that health care professionals counsel patients about regular physical activity (28); however, results from a 1995 national survey indicate that only

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34% of adults had received physician counseling about physical activity during their last medical checkup (29). The results from our study indicate a clear and simple message: walkers need to walk more frequently and/or to engage in a second activity to meet recommendations and to increase additional health benefits from physical activity.

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REFERENCES

1. ANDERSEN, R. E., T. A. WADDEN, S. J. BARTLETT, B. ZEMEL, T. J. VERDE, and S. C. FRANCKOWIAK. Effects of lifestyle activity vs structured aerobic exercise in obese women: a randomized trial. *JAMA* 281:335–340, 1999.
2. BOOTH, M. L., A. BAUMAN, N. OWEN, and C. J. GORE. Physical activity preferences, preferred sources of assistance, and perceived barriers to increased activity among physically inactive Australians. *Prev. Med.* 26:131–137, 1997.
3. DUNN, A. L., B. H. MARCUS, J. B. KAMPERT, M. E. GARCIA, H. W. KOHL, and S. N. BLAIR. Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: a randomized trial. *JAMA* 281:327–334, 1999.
4. HAKIM, A. A., J. D. CURB, H. PETROVITCH, et al, Effects of walking on coronary heart disease in elderly men: the Honolulu Heart Program. *Circulation* 100:9–13, 1999.
5. HAKIM, A. A., H. PETROVITCH, C. M. BURCHFIEL, et al. Effects of walking on mortality among nonsmoking retired men. *N. Engl. J. Med.* 338:94–99, 1998.
6. HU, F. B., R. J. SIGAL, J. W. RICH-EDWARDS, et al. Walking compared with vigorous physical activity and risk of type 2 diabetes in women: a prospective study. *JAMA* 282:1433–1439, 1999.
7. HU, F. B., M. J. STAMPFER, G. A. COLDITZ, et al. Physical activity and risk of stroke in women. *JAMA* 283:2961–2967, 2000.
8. JONES, D. A., B. E. AINSWORTH, J. B. CROFT, C. A. MACERA, E. E. LLOYD, and H. R. YUSUF. Moderate leisure-time physical activity: who is meeting the public health recommendations? A national cross-sectional study. *Arch. Fam. Med.* 7:285–289, 1998.
9. KING, A. C., C. CASTRO, S. WILCOX, A. A. EYLER, J. F. SALLIS, and R. C. BROWNSON. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychol.* 19: 354–364, 2000.
10. LACROIX, A. Z., S. G. LEVEILLE, J. A. HECHT, L. C. GROTHAUS, and E. H. WAGNER. Does walking decrease the risk of cardiovascular disease hospitalizations and death in older adults? *J. Am. Geriatr. Soc.* 44:113–120, 1996.
11. LEE, I-M., K. M. REXRODE, N. R. COOK, J. E. MANSON, and J. E. BURING. Physical activity and coronary heart disease in women: is "no pain, no gain" passé? *JAMA* 285:1447–1454, 2001.
12. MANSON, J. E., F. B. HU, J. W. RICH-EDWARDS, et al. A prospective study of walking as compared with vigorous exercise in the prevention of coronary heart disease in women. *N. Engl. J. Med.* 341:650–658, 1999.
13. NATIONAL INSTITUTES OF HEALTH, CONSENSUS DEVELOPMENT PANEL ON PHYSICAL ACTIVITY AND CARDIOVASCULAR HEALTH. Physical activity and cardiovascular health. *JAMA* 276:241–246, 1996.
14. NATIONAL INSTITUTES OF HEALTH, NATIONAL HEART, LUNG, AND BLOOD INSTITUTE (NHLBI). *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.* Bethesda, MD: NHLBI, 1998, p. 60.
15. PATE, R. R., M. PRATT, S. N. BLAIR, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 273:402–407, 1995.
16. PRATT, M., C. A. MACERA, and C. BLANTON. Levels of physical activity and inactivity in children and adults in the United States: current evidence and research issues. *Med. Sci. Sports Exerc.* 31(Suppl. 11):S526–S533, 1999.
17. RAFFERTY, A. P., M. J. REEVES, H. B. MCGEE, and J. M. PIVARNIK. Compliance with physical activity recommendations by walking for exercise - Michigan, 1996 and 1998. *MMWR* 49:560–565, 2000.
18. REMINGTON, P. L., M. Y. SMITH, D. F. WILLIAMSON, R. F. ANDA, E. M. GENTRY, and G. C. HOGLIN. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981–87. *Public Health Rep.* 103:366–375, 1988.
19. ROCKHILL, B., W. C. WILLETT, J. E. MANSON, et al. Physical activity and mortality: a prospective study among women. *Am. J. Public Health* 91:578–583, 2001.
20. SALLIS, J. F., A. BAUMAN, and M. PRATT. Environmental and policy interventions to promote physical activity. *Am. J. Prev. Med.* 15:379–397, 1998.
21. SCHMID, T. L., M. PRATT, and E. HOWZE. Policy as intervention: environmental and policy approaches to the prevention of cardiovascular disease. *Am. J. Public Health* 85:1207–1211, 1995.
22. SHAH, B. V., B. G. BARNWELL, and G. S. BIELER. *SUDAAN User's Manual, Release 7.5.* Research Triangle Park, NC: Research Triangle Institute, 1997. pp. 6.1–6.33, 8.1–8.44.
23. SIEGEL, P. Z., R. M. BRACKBILL, and G. W. HEATH. The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. *Am. J. Public Health* 85:706–710, 1995.
24. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *Healthy People 2000.* Washington, DC: DHHS, 1991.
25. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *Healthy People 2010* (conference edition, in two volumes). Washington, DC: DHHS, 2000.
26. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
27. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION. Prevalence of leisure-time physical activity among overweight adults: United States, 1998. *MMWR* 49:326–330, 2000.
28. U.S. PREVENTIVE SERVICES TASK FORCE. *Guide to Clinical Preventive Services*, 2nd Ed. Baltimore: Williams & Wilkins, 1996, pp. 611–624.
29. WEE, C. C., E. P. MCCARTHY, R. B. DAVIS, and R. S. PHILLIPS. Physician counseling about exercise. *JAMA* 282:1583–1588, 1999.
30. YUSUF, H. R., J. B. CROFT, W. H. GILES, et al, Leisure-time physical activity among older adults: United States, 1990. *Arch. Intern. Med*. 156:1321–1326, 1996.

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