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Short Communication

National physical activity surveillance: Users of wearable activity monitors as a potential data source

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ABSTRACT

The objective of this study was to assess usage patterns of wearable activity monitors among US adults and how user characteristics might influence physical activity estimates from this type of sample. We analyzed data on 3367 respondents to the 2015 HealthStyles survey, an annual consumer mail panel survey conducted on a nationwide sample. Approximately 1 in 8 respondents (12.5%) reported currently using a wearable activity monitor. Current use varied by sex, age, and education level. Use increased with physical activity level from 4.3% for inactive adults to 17.4% for active adults. Overall, 49.9% of all adults met the aerobic physical activity guideline, while this prevalence was 69.5% among current activity monitor users. Our findings suggest that current users of wearable activity monitors are not representative of the overall US population. Estimates of physical activity levels using data from wearable activity monitors users may be an overestimate and therefore data from users alone may have a limited role in physical activity surveillance.

Wearable activity monitors, such as smartphone apps and wearable devices, are widely used (Nielsen website) and can play an important role in health behavior change (Patel et al., 2015). In addition to these individual level benefits, they may also be useful at the population level for physical activity surveillance. Physical activity surveillance currently relies largely on questionnaires which have a variety of limitations (Fulton et al., 2016). In an attempt to supplement self-reported physical activity data and overcome its potential biases, activity monitors have previously been used by surveillance systems such as the National Health and Nutrition Examination Survey. However, since cost and feasibility may make the use of these monitors to examine physical activity at the population level challenging (Ainsworth and Macera, 2012), researchers have considered using data from a sample of existing users to more feasibly estimate population levels of physical activity. In 2014, a panel of experts on physical activity surveillance called for researchers and public health practitioners to explore and evaluate data from such alternative sources as part of physical activity surveillance (Fulton et al., 2016). In particular, it is necessary to determine whether these data sources may produce biased estimates because of characteristics of activity monitor users. We assessed usage patterns of activity monitors and how the characteristics of users can influence physical activity estimates from this type of sample.

1. Methods

All data came from HealthStyles 2015, an annual consumer mail panel survey using a nationwide sample (response rate = 76.1%: 3550 respondents/4665 panelists surveyed). We excluded 183 respondents with missing data on demographics, physical activity level, or activity monitor usage.

A wearable activity monitor was defined as a step counter, fitness tracking device, or smartphone-based health and fitness app. Respondents were asked "Have you ever used a wearable activity monitor?" Those who responded "No," "Yes, but I am not a current user," and "Yes, I am a current user" were defined as never users, past users, and current users respectively. Respondents were asked about participation in physical activity using questions modified from the National Health Interview Survey. They were then classified into aerobic physical activity levels according to current national guidelines: active (meeting guidelines), insufficiently active (some activity but not enough to meet guidelines), and inactive (no physical activity) (U.S. Department of Health and Human Services, 2008). Being physically active is defined as reporting ≥150 min/week moderate-intensity equivalent activity per week.

Prevalence and 95% confidence intervals were calculated overall and by sex, age group, education level, metropolitan statistical area (MSA) status (metro MSA or nonmetro MSA) (U.S. Census Bureau), and

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Table 1
Prevalence of reported use of wearable activity monitors, by selected characteristics, HealthStyles 2015[a].

Characteristic	Sample Size	Current User % (95% CI)	Past User % (95% CI)	Never User % (95% CI)
Total	3367	12.5 (11.2–13.9)	12.2 (10.9–13.7)	75.3 (73.4–77.1)
Aerobic physical activity level[b]				
Inactive	659	4.3 (2.7–6.6)	10.1 (7.5–13.5)	85.6 (81.8–88.7)
Insufficiently active	1020	9.7 (7.7–12.3)	12.2 (10.0–14.9)	78.0 (74.7–81.0)
Active	1688	17.4 (15.3–19.7)	13.0 (11.1–15.2)	69.6 (66.8–72.2)
Sex				
Men	1694	10.2 (8.6–12.1)	9.5 (7.9–11.4)	80.3 (77.8–82.5)
Women	1673	14.6 (12.6–16.8)	14.7 (12.7–17.0)	70.7 (67.9–73.3)
Age, y				
18–34	655	17.0 (14.0–20.5)	13.1 (10.4–16.5)	69.8 (65.6–73.7)
35–49	652	15.1 (12.1–18.6)	12.1 (9.6–15.2)	72.8 (68.6–76.6)
50–64	1206	9.8 (8.2–11.8)	12.0 (9.7–14.6)	78.2 (75.2–80.9)
≥65	854	6.4 (4.8–8.4)	11.2 (8.6–14.4)	82.4 (78.9–85.4)
Education level				
High school graduate or less	1221	6.6 (5.1–8.7)	8.3 (6.5–10.6)	85.0 (82.2–87.5)
Some college	1057	12.4 (10.0–15.3)	14.2 (11.8–17.0)	73.4 (69.9–76.6)
College graduate	1089	20.4 (17.7–23.3)	15.5 (12.9–18.4)	64.1 (60.6–67.5)
Race/ethnicity				
White, non-Hispanic	2564	12.5 (11.1–14.0)	12.2 (10.7–13.9)	75.3 (73.2–77.3)
Other	803	12.5 (9.9–15.7)	12.2 (9.6–15.4)	75.3 (71.3 to 78.9)
Metropolitan statistical area (MSA) status				
Metro MSA	2864	13.1 (11.6–14.7)	11.9 (10.5–13.4)	75.0 (73.0–76.9)
Nonmetro MSA	503	9.4 (6.7–12.9)	13.8 (10.0–18.8)	76.8 (71.4–81.4)

[a] Respondents were asked, "Have you ever used a wearable activity monitor?" Those who responded "Yes, I am a current user," "Yes, but I am not a current user," or "No" were defined as current, past, or never users, respectively.
[b] Aerobic physical activity level is defined as active (≥150 min/week moderate-intensity equivalent activity), insufficiently active (some moderate-intensity equivalent activity but not enough to meet active definition), and inactive (no moderate-intensity equivalent activity that lasted at least 10 min).

physical activity level. The sample was stratified and balanced on region, household income, population density, age, and household size to create a sample representative of the distribution of the U.S. population. Wald tests were used to identify significant (p value < 0.05) variation by select characteristics.

2. Results

Approximately 1 in 8 respondents (12.5%) reported current use of a wearable activity monitor (Table 1). Prevalence of current use was greater among women compared to men, and increased with

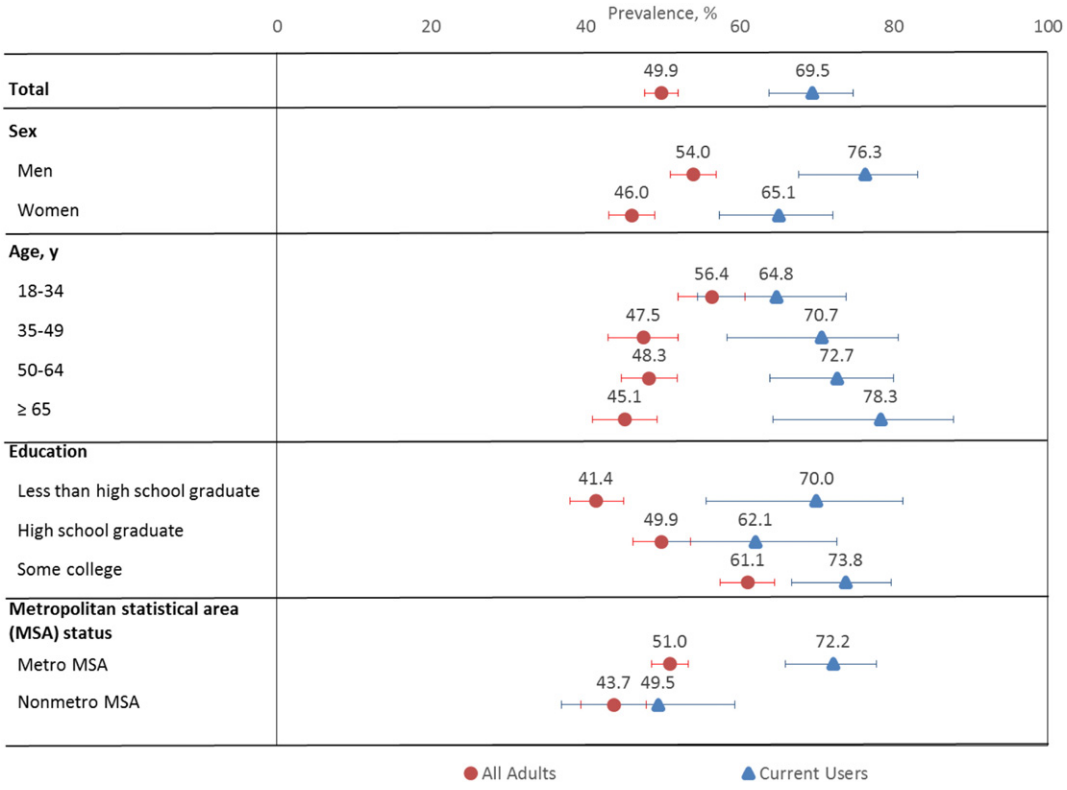

Fig. 1. Prevalence of being physically active,[a] by selected characteristics, for All US adults and for current users of wearable activity monitors,[b] HealthStyles 2015. Note: Error bars represent the lower and upper bounds of the 95% confidence interval. [a]Being physically active is defined as reporting ≥150 min/week moderate-intensity equivalent activity per week. [b]Current users are defined as respondents who answered "Yes, I am a current user" to the question, "Have you ever used a wearable activity monitor?"

decreasing age (p-value for trend <0.001) and increasing education level (p-value for trend <0.001).

Use of wearable activity monitors increased with physical activity level. Current use was reported by 4.3% (95% confidence interval [CI] = 2.7, 6.6) of respondents who were inactive, 9.7% (95% CI = 7.7, 12.3) of those who were insufficiently active, and 17.4% (95% CI = 15.3, 19.7) of those who were active.

Overall, 49.9% of adults reported meeting the aerobic physical activity guideline (Fig. 1), and this prevalence was higher in men and adults living in a metro MSA compared with their counterparts. Overall, prevalence of meeting guidelines increased with decreasing age (p-value for trend <0.001) and increasing education level (p-value for trend <0.001). Among current monitor users, 69.5% met guidelines. Patterns by sex and MSA status were similar in current users compared to those for all adults, although the difference by MSA status was more pronounced. Of all respondents who lived in a metro MSA, 51.0% met guidelines compared with 72.2% of current users who lived in a metro MSA. However, among current users, prevalence of meeting guidelines did not differ by age or education level.

3. Discussion

Our findings suggest that current users of wearable activity monitors are not representative of the overall US population. Data limited to current users may inflate physical activity estimates and identify patterns of physical activity that differ from those found in other population groups or in US adults overall.

This study is limited by potential selection bias from use of a mail panel survey. However, previous research has found a general equivalence between results from random-digit dialed and panel approaches (Pollard, 2002; Fisher and Kane, 2004), and our overall estimate of active adults corresponds with the national estimate from the 2014 National Health Interview Survey (49.9%) (Healthy People 2020). Another limitation is that all measures are self-reported and previous assessments have shown that physical activity can be overestimated when self-reported (Sallis and Saelens, 2000).

4. Conclusion

Although wearable activity monitors may play an important role in helping people change their health behaviors (Patel et al., 2015), data from users alone may have limited application to physical activity surveillance. Despite this, data from existing users of wearable activity monitors could supplement self-reported surveillance data or help define activity patterns among active persons.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflicts of interest

None.

Transparency document

The Transparency document associated with this article can be found, in the online version.

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