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Assessment of Sedentary Behavior With the International Physical Activity Questionnaire

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Purpose: This study explored definitions of sedentary behavior and examined the relationship between sitting time and physical inactivity using the sitting items from the International Physical Activity Questionnaire (IPAQ). ***Methods:*** Participants (N = 289, 44.6% male, mean age = 35.93) from 3 countries completed self-administered long- and short-IPAQ sitting items. Participants wore accelerometers; were classified as inactive (no leisure-time activity), insufficiently active, or meeting recommendations; and were classified into tertiles of sitting behavior. ***Results:*** Reliability of sitting time was acceptable for men and women. Correlations between total sitting and accelerometer counts/min <100 were significant for both long (r = .33) and short (r = .34) forms. There was no agreement between tertiles of sitting and the inactivity category (kappa = .02, P = .68). ***Conclusion:*** Sedentary behavior should be explicitly measured in population surveillance and research instead of being defined by lack of physical activity.

Keywords: health promotion, physical inactivity, health behavior, exercise

Physical inactivity and sedentary behavior are cited as primary contributors to the obesity epidemic.[1] Though leisure-time physical activity levels have changed little over the past few decades,[2,3] sedentary behaviors such as television watching and use of motorized transport have increased and, therefore, might help explain the increase in obesity.[4] Research on sedentary behavior is a public health priority, and thoughtful conceptualization and measurement are precursors to high-quality research.

A major shortcoming of previous research on sedentary behavior is that researchers have not defined and measured sedentary behavior consistently. A common problem is a lack of clarity in referring to sedentary behavior and sedentary

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people, who are often identified as having low levels of physical activity. Tudor-Locke and Meyers[5] explain:

> To date, sedentarism has been inferred according to comparatively low levels of total energy expenditure, time or distance walked, stairs climbed, and/or through lack of self-reported participation in vigorous leisure activities, including sports and exercise.(p 92)

Healthy People 2010 states that *sedentary person* "denotes a person who is relatively inactive and has a lifestyle characterized by a lot of sitting."[6(p 22-36)] Some researchers have suggested that individuals spending less than 10% of their daily energy expenditure in moderate- to high-intensity activities should be classified as sedentary.[7,8]

Some of the confusion that arises from the different definitions might be caused by defining sedentary individuals as those who are inactive or not physically active as opposed to those who spend a great deal of time doing sedentary behaviors. It is inadequate, however, to infer sedentary behavior from lack of physical activity because there is ample evidence that they are independent behaviors that have different effects on health.[3,5,9-12] Thus, defining sedentary people as having deficient levels of physical activity is inaccurate and can confuse attempts to measure the sedentary-behavior construct. We support referring to people with low levels of physical activity as insufficiently active rather than sedentary.[13] Biddle et al assert that sedentary behavior is "a distinct class of behaviors characterized by low energy expenditure."[12(p 30)] This latter definition is more specific and suggests a separate set of behavior domains than presence or absence of physical activities.

Sedentary behavior in adults is an area that can draw on extensive literature on youth. The predominant sedentary behavior studied in children is television viewing. It has been hypothesized that sedentary behaviors such as television watching displace engagement in physical activities and lead to obesity.[12] There is evidence that television watching stimulates the consumption of unhealthful foods.[14,15]

A meta-analysis[16] found significant negative relationships between television and computer/video-game use and body fatness in children and youth, although the effect sizes were small. Relationships of television viewing and computer/video-game use to physical activity were small and negative. Cluster analyses of sedentary behavior support the conclusion that television viewing does not substantially displace physical activity among youth. Youth can report high levels of both physical activity and sedentary pursuits.[17,18]

Studies of adults also have focused on television viewing as a means of examining sedentary behavior. The average US adult spent 29 hours per week watching television in 2003.[19] Cross-sectional and prospective studies generally showed obesity rates 1.5 to 2 times higher among those who watched the most television, even after adjustment for physical activity.[19-31] Some studies have shown mixed results in which relationships were only significant for certain age groups[27,29] or only cross-sectionally.[30]

More recently, researchers have measured a wider range of sedentary behaviors. There is less literature that is based on questions about time spent sitting.[19,20,32,33] The limitations in this set of literature are that the measures have been brief, some focused only on recreational sitting time, and most did not report any reliability or validity data. One study reported moderately high reliability correlations for

items from the Western Australian Incidental Physical Activity Questionnaire that assessed time spent sitting and higher coefficients for items measuring computer and television use.[34] Unfortunately, there is no consistency in the way sitting time is measured, so studies cannot be compared. However, all of these studies reported a positive relationship between sitting time and weight status.[19,20,32,33]

Population-surveillance surveys aim to measure indicators of sedentarism in large populations and do not comprehensively assess health behaviors. Population surveillance in adults has predominantly defined sedentary lifestyles based on lack of physical activity. For example, the Behavioral Risk Factor Surveillance System (BRFSS) classifies people as inactive if they do not engage in leisure-time activities.[35-37] Such classification methods do not directly address the sedentary behaviors that would contribute to inactivity,[9] but at present, they are the primary source of population estimates of sedentary behavior in the United States. *Healthy People 2010* states that "the message that a sedentary lifestyle plays a role in both overweight and weight loss needs to be addressed better."[6(p 22-6)]

There are 2 important problems with the measurement of sedentary behavior. One is the lack of consistency with terminology and confusing definitions of sedentary individuals and sedentary behaviors. Second, there is an overreliance on using television viewing as a proxy measure of sedentary behavior. Thus, there is a need for a brief, yet reliable, and valid measure of sedentary behavior that can be included in population-monitoring surveys so that the independent contributions of sedentary behaviors to obesity and other health outcomes can be determined.

The purpose of the present study was to extend previous reports[38] of the reliability and validity of the sitting item from the International Physical Activity Questionnaire (IPAQ) to assess measurement properties by gender. To evaluate the adequacy of using lack of physical activity during leisure time as the definition of sedentarism, the second aim was to compare the relationship of sedentary behavior measured by IPAQ's sitting item with inactivity measured using IPAQ's physical activity questions scored to reflect *Healthy People 2010* definitions of inactivity.

Methods

Procedure

The reliability and validity of the IPAQ was originally tested in 12 countries with a total sample exceeding 2000.[37] Eight IPAQ versions were tested. In the original reliability and validity study, the authors concluded that the last-7-days time frame was recommended.[38] The site subsamples included in the present study were selected because they used the same version of the IPAQ and had validity data. Thus, included sites had to have administered both the short and long IPAQ versions that used the recommended past-week reference period, and the IPAQ had to have been self-administered. This resulted in the inclusion of data from 4 sites across 3 countries.

Data Collection

Data from the original IPAQ reliability and validity study sites—Bristol (UK), San Diego (USA 1), South Carolina (USA 2), and the Netherlands—were included in

this study. All sites used the English version of the IPAQ except the Netherlands sample, which administered a Dutch version. Although most IPAQ versions have been translated and back-translated into English, the Dutch version was not back-translated, but it followed the cultural-adaptation guidelines described in Craig et al.[37] All versions are available at http://www.ipaq.ki.se/ipaq.htm. Most sites used convenience samples consisting of staff, students, or others affiliated with universities. These sites' samples had generally high education and socioeconomic status (see Table 1). More detailed information has been previously presented.[38]

Data were collected at all sites following a standard protocol for administering the questionnaire on 3 occasions. During visit 1, participant demographic information was collected, consent was given, and the accelerometer was initialized and given to the participant to wear for 1 week. At visit 2, 1 week after visit 1, participants returned the accelerometers and each completed an IPAQ. The IPAQ was readministered 3 to 7 days later (visit 3) to allow overlapping days for test–retest analyses.

Measures

Sitting Items. The sitting items in the long and short versions of the IPAQ last-7-days version were similar. For both versions, participants were instructed to think about the time they spent sitting at work, at home, while doing course work, and during leisure time. They were asked to estimate in total the number of hours and minutes per day they spent sitting for a weekday and a weekend day. For IPAQ long forms, however, participants were instructed not to include time spent sitting in a motor vehicle. Time spent in motorized transportation was assessed separately on the long form only. The exact item wording is available at www.ipaq.ki.se.

Objective Measure of Sedentary Time. The Computer Science and Application Inc's (Shalimar, FL) accelerometers (CSA model 7164, now available from www.theactigraph.com) were used to objectively assess participants' sedentary time. Participants were instructed to wear the accelerometer during waking hours for 7 days. Accelerometer data were included in analyses if there were at least 600 minutes of time recorded each day for at least 5 days, 1 of which had to be a weekend day.[37] Data were stored in 1-minute intervals. Minutes with counts <100 per minute were considered to represent time spent in sedentary pursuits.[39] The use of counts <100 per minute captures time spent sitting or lying still such as while watching television and playing video games[39-42] and has been used as the cut point for sedentary behavior in previous studies with youth.[39,43] Using this cutoff helps distinguish between engaging in sedentary activities and light activities (eg, ironing, washing dishes, sweeping the floor, and cooking), which have been measured at 150 to 400 counts per minute.[44,45]

Measure of Physical Inactivity and Recommended Physical Activity. Definitions of inactivity and recommended physical activity used in *Healthy People 2010*[6] and US national surveillance data[36] were approximated with data from IPAQ items. The BRFSS used in US national surveillance asks individuals to take account of recreational activity and gardening and yard activities, and people who report no such activities are classified as inactive. In the present study, based on appropriate IPAQ items, individuals were classified as meeting physical activity recommendations

Table 1 Sample Characteristics

Site	Gender, N (% male)	Mean age in y (SD)	Mean y of education (SD)	Mean h/wk of total sitting and total sitting including transportation (SD)[a]	Mean h/wk accelerometer counts <100 (SD)	% inactive, insufficiently active, active during leisure time
UK	157 (48.4)	35.3 (10.4)	16.3 (3.6)	46.45 (19.2), 53.80 (23.0)	53.17 (8.8), N = 126	11.1, 45.1, 43.8
Netherlands	74 (45.9)	32.7 (10.9)	—[b]	55.49(19.4), 60.04(21.0)	55.55 (10.5), N = 34	3, 48.5, 48.5
USA 1	28 (25)	48.9 (6.1)	—[c]	47.54 (26.11), 64.33 (27.3)	48.88 (10.1), N = 26	7.4, 29.6, 63
USA 2	30 (46.7)	36.1 (12.6)	17.3 (3.0)	37.86 (20.78), 53.01 (19.8)	53.13 (9.8), N = 26	6.7, 30, 63.3
Total sample	289 (45.1)	35.9 (11.3)	16.3 (3.4)	48.69 (20.4), 56.03 (23.52)	53.02 (9.5), N = 212	8.6, 41.7, 49.6

[a] Derived from the International Physical Activity Questionnaire (IPAQ) long form.

[b] 70% of the Netherlands sample had >18 y of education.[38]

[c] Education level not available for USA 1 sample.

(30 minutes of moderate recreational, walking, or gardening activity 5 days per week or 20 minutes of vigorous recreational or gardening activity 3 days per week), being insufficiently active (not meeting recommendations but not completely inactive), or inactive (no moderate or vigorous recreational or gardening activities).

Analysis

Analysis occurred in 3 parts. First, test–retest reliability of the sitting items was examined separately for men and women for each of the following definitions of sitting. For the long form, test–retest correlations were conducted for weekday, weekend, weekday + weekend (total), transportation sitting, and transport + weekday + weekend (grand total) sitting. For the short form, test–retest correlations were conducted for weekday, weekend, and weekday + weekend (total) sitting. Retests (at visit 3) were performed 3 to 7 days after the initial test at visit 2. Participants who completed the IPAQ administration more than 8 days after the initial test were excluded from the analyses. Spearman correlations were used because data were nonnormally distributed.

Next, to assess criterion validity of the sitting item by gender, total time spent sitting was correlated with the number of accelerometer counts <100 per minute. For the long form, total sitting and grand-total sitting (which includes sitting for transportation) were correlated with accelerometer counts <100 per minute. For the short form, total sitting was correlated with accelerometer counts <100 per minute.

Finally, to assess the agreement between classification of individuals identified as inactive during leisure time and those identified as spending high amounts of time sitting, kappa statistics were run. Participants' classification as inactive, insufficiently active, or meeting physical activity guidelines was entered as 1 variable. Participants were categorized into tertiles of sitting behavior based on their responses to the IPAQ long-version sitting items, and this was entered as the second variable. Kappa analyses were conducted only for the long form because it contained more specific domains that allowed gardening and yard activity to be taken into account separately from recreational activities to replicate BRFSS criteria.

Results

Demographics

Participant characteristics are presented in Table 1. There were 28 to 157 participants per site. All sites had more women than men participate in the study. In general, the participants reported high levels of education.

Test–Retest Reliability

Test–retest Spearman correlations for the long form were very good for men and women (Table 2). Reliability coefficients were similar for the different components of sitting—weekday, weekend, total, transport, and grand-total sitting. Men and women had similar reliability coefficients on all sitting items. The coefficients ranged from .40 (USA 2, time spent sitting on the weekend) to 1.0 (USA 1, time

Table 2 Test–Retest Reliability Coefficients for the Sitting Items of the IPAQ Long Form

Sample	N	Weekday	Weekend	Total[a]	Transport (N)[b]	Grand total[c] (N)[b]
UK						
men	65	.81	.78	.83	.76 (68)	.82 (68)
women	78	.64	.79	.66	.85 (79)	.65 (79)
all	145	.72	.79	.75	.81 (149)	.74 (149)
Netherlands						
men	28	.96	.95	.97	.95 (29)	.78 (29)
women	38	.96	.88	.93	.94 (39)	.93 (39)
all	66	.96	.91	.96	.93 (68)	.87 (68)
USA 1						
men	7	1.0	1.0	1.0	.96	1.0
women	18	.92	.95	.94	.83	.91
all	25	.95	.97	.96	.84	.95
USA 2						
men	13	.91	.40	.91	.85 (14)	.89 (14)
women	16	.82	.90	.86	.93	.88
all	29	.82	.78	.87	.91	.85
Total						
men	109	.86	.82	.87	.80 (113)	.83 (113)
women	144	.77	.85	.78	.87 (146)	.77 (146)
all	255	.81	.84	.82	.84 (261)	.81 (261)

Abbreviation: IPAQ, International Physical Activity Questionnaire.

[a] Total sitting = weekday + weekend sitting.

[b] Sample sizes that differ from the sample sizes in column 2 are reported in parentheses.

[c] Grand-total sitting = total + transportation sitting.

spent sitting on a weekday, weekend, and total sitting) for men and from .64 (UK, time spent sitting on a weekday) to .96 (Netherlands, time spent sitting on a weekday) for women. Most of the correlations were above .75, indicating very good to excellent test–retest reliability for the sitting items in the IPAQ past-7-days long form.

Test–retest reliabilities for the short form were also in acceptable ranges for men and women (Table 3). Coefficients were slightly lower than those observed for the long form for weekday and weekend sitting but similar for total sitting. Again, men and women tended to have similar test–retest correlations. Correlations ranged from .77 (UK, weekday sitting) to .98 (USA 1, weekend sitting) for men and from .62 (UK, weekday sitting) to .96 (Netherlands, weekday sitting) for women. Most of the correlations were above .70, again indicating acceptable test–retest reliability for the sitting items in the IPAQ past-7-days short form.

Table 3 Test–Retest Reliability Coefficients for the Sitting Items of the IPAQ Short Form

Sample	N	Weekday	Weekend (N)[a]	Total[b] (N)[a]
UK				
men	65	.79	.77 (64)	.81
women	79	.62	.71 (80)	.63 (80)
all	146	.70	.75	.73 (147)
Netherlands				
men	25	.94	.90	.93
women	39	.96	.92	.94
all	64	.96	.91	.95
USA 1				
men	7	.86	.98	.79
women	21	.96	.85	.94
all	28	.93	.87	.92
USA 2				
men	14	.83	.79	.86
women	16	.77	.85	.90
all	30	.79	.84	.85
Total				
men	106	.61	.70 (105)	.84
women	149	.58	.73 (150)	.77 (150)
all	257	.59	.72	.81 (258)

Abbreviation: IPAQ, International Physical Activity Questionnaire.

[a] Sample sizes that differ from the sample sizes in column 2 are reported in parentheses.

[b] Total sitting = weekday + weekend sitting.

Criterion Validity

Spearman correlation coefficients between accelerometer counts and sitting time reflected low to moderate agreement in general (Table 4). All correlations were positive except among men in the Netherlands sample, in which a negative correlation with accelerometer counts was observed. Overall, women had higher correlations than men. Data about sitting from the short and long forms performed similarly against the accelerometer estimates of sedentary behavior. Most correlations were above .25.

Agreement With Guidelines

Figure 1 shows the relationship between tertiles of self-reported sitting and the cut points for physical inactivity, insufficient activity, and meeting recommendations. The kappa statistic was not significant, indicating poor agreement between the tertiles of time spent sitting and various categories of activity.

Table 4 Spearman Correlation Coefficients for Sitting Items With Accelerometer Counts <100 per min for Long and Short IPAQ Forms

Sample	N	Long form	Long form + transportation (N)[a]	Short form (N)[a]
UK				
men	56	.24	.22 (58)	.24
women	61	.28	.35	.29 (62)
all	118	.24	.25 (120)	.25 (119)
Netherlands				
men	11	–.16	–.16	–.48 (9)
women	19	.44	.56	.43
all	30	.26	.35	.22 (28)
USA 1				
men	6	.31	.37	.37
women	20	.41	.30	.52
all	26	.30	.26	.45
USA 2				
men	13	.60	.63	.59
women	13	.37	.39	.48
all	26	.50	.49	.49
Total				
men	86	.26	.23 (88)	.24 (84)
women	113	.40	.38	.43 (114)
all	200	.33	.31 (202)	.34 (199)

Abbreviation: IPAQ, International Physical Activity Questionnaire.

[a] Sample sizes that differ from the sample sizes in column 2 are reported in parentheses.

Discussion

The current study assessed measurement properties of the IPAQ sitting items and explored current definitions of sedentary behavior and inactivity. In general, the sitting items from the last-7-days IPAQ were reliable and valid among participants from several countries. The differences between the reliability coefficients for men and women were small, thus demonstrating that the sitting items were reliable to use in both populations.

In this study, the correlations between the IPAQ sitting time and accelerometer counts depicting sedentary behavior (<100 counts/min) were small to medium. The correlations were comparable to the small but significant relationships reported between multiple self-reported measures of physical activity and accelerometers.[46] Thus, reported sitting is approximately as valid as reported physical activity. There was, however, a notable unexpected finding of negative associations between reported sitting and accelerometer sedentary time for men from the Netherlands. There could be a few explanations for this anomalous finding. The IPAQ in the Netherlands was administered in Dutch, but all other versions were administered in English. Because the Dutch version was not back-translated, there is the possibility of errors in translation. In addition, individuals in the Netherlands tend to

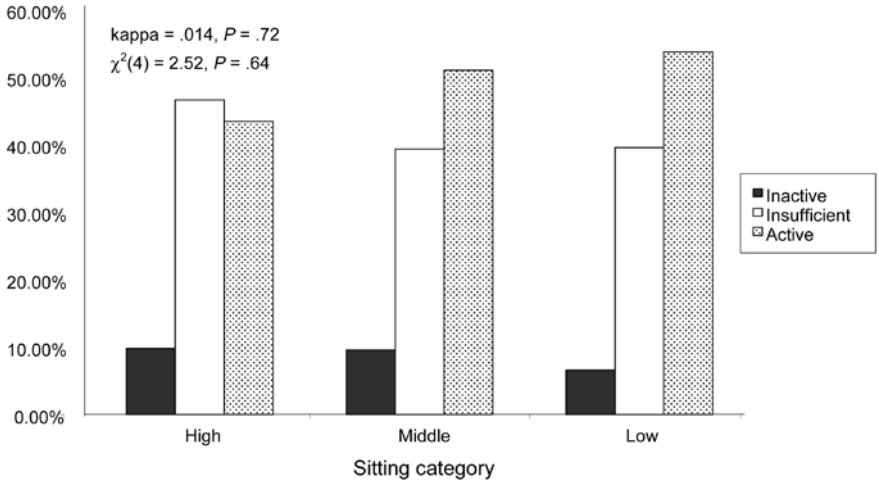

Figure 1 — Agreement between tertiles of sitting and physical inactivity categories based on the IPAQ long form for the total sample. *Note.* Sample divided into high, middle, or low sitting time derived from the IPAQ long-form sitting item. Sample categorized as active (meeting physical activity recommendation—30 minutes of moderate recreational, walking, or gardening activity 5 days per week or 20 minutes of vigorous recreational or gardening activity 3 days per week), insufficiently active (not meeting activity recommendation but not completely inactive), or inactive (no moderate or vigorous recreational or gardening activities).

engage in high amounts of biking, which is not measured by accelerometers and could be counted as sedentary time.

The test–retest reliability for all of the sitting items was >.75, indicating high reliability for a self-reported measure. For a brief measure, the IPAQ sitting items have adequate reliability and validity to use for surveillance. When the focus of research is to improve understanding of sedentary behavior specifically, a more detailed measure should be used. Except for men from the Netherlands, reliability and validity of the IPAQ sitting items appear to be generalizable to men and women in multiple countries.

Describing individuals who are inactive during leisure time as sedentary was shown to be a misnomer. Although it is true that the concepts of inactivity and sedentary behavior are conceptually related, these behaviors are empirically distinct and should be considered as such both in measurement methods and the terms used to define them. Using these terms interchangeably causes ambiguity. Data from the present study demonstrated the lack of agreement between what can be characterized as sedentary behavior (sitting time) and what can be characterized as physical inactivity. Participants in this study who reported high amounts of sitting were just as likely to be classified as active on the physical activity measure as those who reported sitting the least. Among the highest tertile of sitters, 44% were classified as meeting physical activity guidelines. This suggests that individuals who are sedentary for large amounts of time can also engage in the recommended

levels of leisure-time activity; thus, the 2 behaviors are not mutually exclusive. It is possible that individuals who sit for lengthy amounts of time at work and watch a lot of television might still go to the gym for 30 minutes a few times per week and, thus, be considered active. These individuals might meet physical activity recommendations, but their high levels of sedentary behavior throughout the day could be independently associated with health problems.

Accurate and reliable measures are needed specifically to assess sedentary behavior so that associations with health outcomes can be appropriately and feasibly studied. Thought should be given in identifying the specific components of the sedentary-behavior domain that should be measured. Using the definition of Biddle et al[12] that sedentary behavior is "a distinct class of behaviors characterized by low energy expenditure,"(p 30) sedentary behaviors can include television watching, talking on the phone, reading, playing video or computer games, doing office work, listening to music, driving or riding in a car, and using the computer. Each of these activities can be performed in a variety of settings: at home, in offices, at schools, while commuting, or in social settings. It is possible that regardless of physical activity level, reducing sedentary behaviors in each of these settings could provide health benefits, but the health outcomes of sedentary behavior need to be documented more rigorously with improved measures. By specifically defining the behaviors that might be included when assessing sedentary behaviors, more targeted intervention programs and policy recommendations can be developed to reduce sedentary behaviors.

Strengths and Limitations

Limitations of the study include the use of a convenience sample of participants who were highly educated, resided in developed countries, and were not necessarily representative of the general population in that they might have provided more reliable self-reports than other groups. The population examined contained some students and individuals with university-based employment who might sit for longer periods of time and might have different relationships between sedentary time and physical activity than other populations. Future research will need to examine the measurement properties of sedentary-behavior measures in more generalizable populations. The IPAQ was readministered a minimum of 3 days after initial administration. There is a chance that some individuals remembered what they had recorded in the initial visit, and this could have inflated test–retest reliability scores. Partly because physical activity is overestimated by the IPAQ,[47,48] few people were classified as physically inactive, and the small cell sizes could have contributed to the lack of association between sedentary behavior and inactivity. The validity of using accelerometer counts <100 per minute as a measure of sedentary behavior is not established, and further research, especially in adults, is warranted. However, other objective measures of sedentary behavior are not available, and the cut point of <100 counts per minute has some empirical support.[39,43] The low sample sizes could have affected validity correlations for the Netherlands, USA 1, and USA 2 samples. The brevity of the IPAQ sitting items might hinder accurate measurement of total sedentary behavior. It might be difficult for people to retrospectively include all sedentary behavior without specific examples and prompting, resulting in recall error. Spearman correlations were used to validate the IPAQ sitting items

in the current study, and Spearman correlations do not take account of agreement in the actual values; thus, it is possible to have high correlations and low agreement between measures.

A main strength of the IPAQ sitting measure is that it is a brief measure of sedentary behavior that is suitable for use in large studies or for population monitoring in which there is a paucity of accurate data on the prevalence of sedentary behavior. An additional strength is that, to our knowledge, IPAQ sitting items are the only sedentary-behavior measures with validity and reliability data for adults.

Conclusions

Valid and feasible measures that specifically assess sedentary behaviors rather than a lack of activity are needed for monitoring sedentary behaviors in populations. One population-monitoring survey that has begun to incorporate measures specific to sedentary behavior is the US National Health and Nutrition Examination Survey, which incorporates a measure of television and computer use and asks a general question about whether activities during the day mostly involve sitting, standing and walking, or more heavy work.[49] It would be useful for surveillance questionnaires to also include sedentary measures that examine more than television and computer use.

Being able to measure patterns of sedentary behavior can allow further research into whether high volumes of sedentary behavior are harmful to health or whether low amounts of sedentary behavior have protective effects on health. Developing reliable and valid measures of sedentary behavior that cover the many domains of sedentary behavior in 1 instrument would be useful for smaller-scale studies and intervention research.

Rather than deducing sedentarism from instruments that measure physical activity, sedentary behaviors should be explicitly measured. The IPAQ was developed as a surveillance measure of physical activity and included specific items to assess sedentary behavior. The IPAQ sitting items have adequate reliability and validity for women and men from multiple countries and, thus, are an advance on the current physical activity–surveillance methods for assessing sedentary behavior. Using measures specific to sedentary behaviors will help clarify the definitions of sedentary behavior and sedentary people, which have been confused in previous research, and further elucidate the independent health effects of sedentary behaviors. The term *sedentary* should be used to refer to behaviors that are sedentary rather than people who are inactive. Defining people as inactive based on a lack of leisure-time physical activity can be useful, but care should be taken not to infer that inactive individuals engage in excessive sedentary behavior.

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