Practice of Epidemiology

Validation of a New Brief Physical Activity Survey among Men and Women Aged 60–69 Years

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The Stanford Brief Activity Survey (SBAS), a new two-item physical activity survey, and the Stanford Seven-Day Physical Activity Recall (PAR) questionnaire were administered to men and women, aged 60–69 years, in the Atherosclerotic Disease VAscular functioN and genetiC Epidemiology (ADVANCE) Study. Frequency distributions of SBAS activity levels, as well as a receiver operating curve, were calculated to determine if the SBAS can detect recommended physical activity levels of 150 or more minutes/week at moderate or greater intensity, with PAR minutes/week. Data were collected between December 2001 and January 2004 from 1,010 participants (38% women) and recorded. Subjects were 65.8 (standard deviation: 2.8) years of age, 77% were married, 55% were retired, 23% were college graduates, and 68% were Caucasian. SBAS scores related significantly in an expected manner to PAR minutes/week (p < 0.01), energy expenditure (kcal/kg per day) (p < 0.01), and selected cardiovascular disease risk biomarkers (p < 0.01). The SBAS of physical activity at moderate intensity had a sensitivity of 0.73 and a specificity of 0.61. The SBAS is a quick assessment of the usual amount and intensity of physical activity that a person performs throughout the day. The SBAS needs further validation in other populations but demonstrated the potential of being a reasonably valid and inexpensive tool for quickly assessing habitual physical activity in large-scale epidemiology studies and clinical practice.

Abbreviations: MET, metabolic equivalent; PAR, Stanford Seven-Day Physical Activity Recall; SBAS, Stanford Brief Activity Survey.

Regular participation in physical activity is associated with a reduction in cardiovascular disease risk and in improvements in physical and psychological health (1). However, the majority of adults in the United States have adopted sedentary lifestyles (2, 3). Currently, national recommendations (1, 4) are that all persons engage in at least 30 minutes of moderate-intensity physical activity (from three to six metabolic equivalents (METs)) on most, if not all, days of the week. Moreover, sedentary individuals are advised to achieve a minimum energy expenditure of 1,000 kcal/week from added physical activity (5).

Accurate assessment of physical activity in a free-living population is difficult and can be time consuming for participants and staff. A number of methods for assessing physical activity and energy expenditure exist, each with strengths and limitations, and are used in a variety of settings ranging from the laboratory to large population-based...
surveys (6, 7). Procedures include the use of doubly labeled water to measure energy expenditure over days or weeks. Ambulatory monitoring devices have been used to continuously record body movement by pedometers or accelerometers or physiologic functions that respond to changes in activity level, such as heart rate, ventilation rate, or body temperature. Global positioning system units have been used to determine changes in location, and they may provide additional information on where people exercise (8). However, physical activity has been assessed most frequently using a wide variety of physical activity logs and questionnaires (9).

The “gold standard” for assessing energy expenditure resulting from physical activity is the doubly labeled water method (10–12). Doubly labeled water provides an accurate estimate for overall energy expenditure, but it is unable to establish the type, frequency, duration, or intensity of the physical activities performed. Moreover, doubly labeled water is not practical for large-scale studies because of its high cost, high subject burden, and intrusiveness (10, 11). Similarly, continuous ambulatory assessments of motion or physiologic measures have been limited use in large-scale surveys because of high cost, subject burden, and staff demands. One of the most frequently used procedures shown to have reasonable test-retest reliability and validity is the interviewer-administered physical activity recall questionnaire (13–15).

Physical activity recall questionnaires typically assess the type, intensity, frequency, and duration of physical activity during the past day, week, month, or year. Recall surveys are less likely to influence a person’s behavior and less burdensome for subjects than daily activity logs or diaries. The Stanford Seven-Day Physical Activity Recall (PAR) has been used in epidemiologic, clinical, and behavioral studies since its creation in the early 1980s (16–18). The short-term test-retest reliability, content, known groups, and convergent validity of the PAR have been reported. In addition, the PAR has been utilized among diverse populations from 16 to 79 years of age, reflecting its versatility (12, 15, 18, 19).

However, collecting the PAR places a fair amount of burden on subjects and staff. Typically, PAR requires 30–45 minutes to administer and an additional 10–15 minutes to review and code. This can eliminate PAR from consideration in comprehensive surveys where that much time is unavailable. One of the authors (W. L. H.) therefore created a new two-item self-administered physical activity questionnaire, the Stanford Brief Activity Survey (SBAS), which requires 5 minutes or less for subjects to complete. This paper reports the result of a validation study comparing the SBAS with the PAR in a study of 1,010 adults where it was possible to administer both instruments.

The study objectives were to determine 1) the validity of the SBAS, when compared with the PAR, for classifying subjects into different physical activity categories and 2) how well the SBAS can detect the recommended physical activity levels of 150 or more minutes/week at moderate intensity or greater, using PAR minutes/week. Secondary goals were to determine the frequency distribution of responses to the SBAS, the association between SBAS activity categories and selected cardiovascular disease risk biomarkers, and if gender influences the frequency distributions or sensitivity and specificity of the SBAS at moderate-intensity activity or greater.

MATERIALS AND METHODS

Sample

Subjects were healthy controls in a case-control study assessing environmental, behavioral, and genetic risk factors for cardiovascular disease, the “Atherosclerotic Disease VAscu lar functio N and geneti C Epidemiology” (ADVANCE) Study. A total of 84,590 men and women aged 60–69 years (as of January 6, 2001) who were members of the Northern California Kaiser Permanente Medical Care Program were identified in the health plan’s electronic databases as potentially eligible participants, after exclusion of those with a diagnosis of cardiovascular disease, cancer (other than nonmelanoma skin cancer), renal failure, liver cirrhosis, dementia, or human immunodeficiency virus/acquired immunodeficiency syndrome or with a source of care greater than 50 miles (80.47 km) from the clinic used for data collection. A total of 1,000 subjects were targeted for enrollment in the study. Invitation letters in cohorts of 200 were sent to physicians of potential participants to confirm subject eligibility. A total of 3,054 letters were sent to physicians who eliminated 82 persons. Invitation letters were then sent to potential participants, followed by phone screen to further confirm eligibility. A total of 1,390 were found eligible during the telephone screen, 1,063 were interested in participating, and 1,023 were subsequently enrolled. Complete physical activity data collected between December 2001 and January 2004 were available from 1,010 subjects. Subjects were not excluded on the basis of current physical activity level or body mass index.

Data collection instruments

The Stanford Brief Activity Survey. The SBAS, developed as a self-administered questionnaire that could be completed within 5 minutes, was designed to obtain a quick assessment of the usual amount and intensity of physical activity that a person currently performs throughout the day. The SBAS contains two items. The first item describes different kinds of on-the-job activity, while the second item describes various leisure-time activities. Each item has five response choices. The respondent selects one response that best describes his/her on-the-job activity and one that best describes his/her leisure-time activity. Each response choice includes a global statement about the activity and the dimensions of frequency, intensity, time, and type of activity.

Two investigators established the face and content validity of the SBAS by independently grading each response category in the inactive, light, moderate (3.0–4.9 METs), hard (5.0–6.9 METs), and very hard (≥7.0 METs) activity categories, using established metabolic equivalents (20). Interrater reliability was established with a comparison of the independent scoring of categories and resulted in a scoring mechanism representing five different activity categories,
ranging from inactive to very-hard intensity (refer to Appendix).

By use of the scoring illustrated in Appendix figure 1, the intersection of a subject’s on-the-job activity (A–E) response on the vertical axis with his/her leisure-time activity (F–J) response on the horizontal axis is determined, indicating the subject’s current activity category. For example, a person working in an office who mainly sits at a desk all day and rides a bicycle for 30 minutes/day, five times per week, would choose “B” as his/her on-the-job activity and “J” as his/her leisure-time activity. The intersection of these two responses on Appendix figure 1 would place the person in a very hard-intensity activity category (horizontal lines). On the other hand, a person who works full time as a carpenter performing some hard labor during the day and plays golf once a week on the weekends would choose “D” as his/her on-the-job activity and “G” as his/her leisure-time activity. The intersection of these two responses on Appendix figure 1 would place the person in a moderate-intensity activity category (solid white). The SBAS instructions (with figures) would place this person in a moderate-intensity activity category. The intersection of these two responses on Appendix figure 1 would place this person in a hard-intensity activity category (horizontal lines). The SBAS instructions (with instruments) and scoring are provided in the Appendix.

Stanford Seven-Day Physical Activity Recall. The PAR is a semistructured interview designed to estimate the amount of time that a person engaged in moderate-, hard-, and very hard-intensity activities during the previous 7 days (14, 17). The tool has 14 items to estimate energy expenditure (kcal/kg per day). A trained interviewer guides the subject through the recall process, day-by-day, to determine the duration and intensity of physical activities performed, as well as time spent sleeping. Cue cards provide examples of the various levels of activities (e.g., moderate = mopping, brisk walk; hard = construction work, tennis doubles; very hard = chopping wood, running) (17). Time spent in light activity is estimated by subtracting the time included in sleep and moderate-, hard-, and very hard-intensity activities from the total 24 hours/day (17). Energy expenditure is estimated from the hours spent sleeping and time spent in light-, moderate-, hard-, and very hard-intensity physical activities and then multiplied by the average MET value for each intensity category.

A detailed manual is available for interviewer skill preparation with comprehensive instructions on interviewing techniques, as well as a phone script. The aim of the standardized interview procedure is to increase agreement among interviewers and within interviewers over time.

Data collection procedure

A self-administered baseline health survey was mailed to participants for completion prior to their visit. This survey was brought to their clinic visit and addressed family and personal health, smoking history, and psychosocial measures, including the SBAS. Surveys were reviewed for completeness at the beginning of the clinic visit. Staff persons were available to explain or assist subjects with individual survey items as needed. The information obtained included age, gender, marital status, educational level, employment status, household income, birthplace, and race/ethnicity. Self-reported medical history included previous hospitalizations, myocardial infarction, hypertension, high cholesterol, diabetes, smoking status, alcohol consumption, major medical conditions, surgical procedures, major depression, and cancer.

Subjects were asked to bring all current medications for review at the baseline visit, and these were recorded by study staff. Blood pressure, height, weight, and waist circumference were obtained using standard methods. The PAR was administered to all subjects at the end of their clinic visit by a certified interviewer. Fasting blood samples were drawn to obtain DNA for genetic studies and plasma for determination of lipid and lipoprotein levels, glucose, insulin, and C-reactive protein. Plasma and serum were also stored for future studies.

Data analysis

All forms were reviewed for accuracy and completeness at the time of data collection. Frequencies were run on each variable to check for extreme values. Data were analyzed using SAS, version 9.1, software (SAS Institute, Inc., Cary, North Carolina). Descriptive statistics were calculated on all variables. Frequency distributions of SBAS activity levels were calculated. Regression analysis across SBAS activity categories for significant trend (p < 0.05) was performed. Receiver operating curves were calculated to determine if SBAS could detect recommended physical activity levels of 150 or more minutes/week at moderate or greater intensity, derived from PAR minutes/week.

Ethical issues

Approval to conduct the study was obtained from the institutional review boards at Stanford University Medical School and the Kaiser Foundation Research Institute. The investigation was carried out according to the principles outlined in the Declaration of Helsinki, including written informed consent from all subjects.

RESULTS

Subjects were on average 65.8 years of age; the majority were married, retired, and Caucasian; and 23 percent had graduated from college (table 1). Despite being selected as a healthy cohort, the subjects had a reasonably high prevalence of hypertension, hyperlipidemia, diabetes, metabolic syndrome, and obesity. Compared with women, the men were more likely to be married, to have diabetes, and to have a body mass index greater than 25 kg/m² (p < 0.01) (table 1).

A total of 64 percent of subjects in this study met the national recommendations of 150 or more minutes/week of moderate- or higher-intensity activity, derived from PAR. Subjects meeting these recommendations reported 559 minutes/week of moderate- and higher-intensity activity, while subjects failing to meet this criterion reported only 61 minutes/week (p < 0.01). The estimated mean energy expenditure for subjects meeting the national physical activity recommendations was 36.1 (standard deviation: 3.3) kcal/kg per day, while subjects failing to meet these
requirements had an estimated mean energy expenditure of 32.2 (standard deviation: 0.7) kcal/kg per day (p < 0.01).

Stanford Brief Activity Survey levels

The frequency distributions of scores derived from the SBAS to categorize subjects according to on-the-job and leisure-time activity levels are provided in figure 1. Of the 1,010 subjects, 50.4 percent reported no job, and 46.3 percent reported primarily light- or moderate-intensity activity on the job (categories B and C), while just 3 percent reported hard or vigorous on-the-job activity (categories D and E). Sixty percent of subjects reported performing moderate- or higher-intensity leisure-time activity with sufficient frequency to meet national recommendations (categories H, I, and J) in contrast to 26 percent reporting no regular leisure-time activity (category F) and 13.9 percent reporting light- or sporadic moderate-intensity activity (category G).

Comparison of Stanford Seven-Day Physical Activity Recall and Stanford Brief Activity Survey activity levels

When the scores for on-the-job and leisure-time activity from the SBAS were combined into the five activity categories, they had a reasonably normal distribution (table 2). These categories were able to discriminate different activity levels, ranging from inactive to very hard intensity, in accordance with total daily energy expenditure (kcal/kg per day) derived from the PAR (across groups: p_trend < 0.01). The mean estimated kcal/kg per day ranged from 33.3 (standard deviation: 2.5) for the inactive SBAS category to 37.4 (standard deviation: 4.4) for the very hard-intensity category. At a body weight range of 60–90 kg, subjects in the very hard-intensity category were expending approximately 300 kcal more per day than were subjects in the inactive group.

Reported physical activity levels at a moderate or greater intensity using the SBAS were 61 percent (women: 60.7 percent; men: 61.5 percent), similar to values obtained from the PAR (64 percent). In addition, the associations between SBAS activity categories and selected cardiovascular disease risk biomarkers that are favorably influenced by higher levels of habitual physical activity or cardiorespiratory fitness were determined. As shown in table 2, subjects in the higher activity categories had more favorable cardiovascular disease risk factor profiles than did their less active counterparts. Body mass index, high density lipoprotein cholesterol, triglycerides, fasting blood glucose and insulin, and metabolic syndrome were statistically significant for trends across categories of physical activity levels (p < 0.01).


### TABLE 1. Subject demographics and cardiovascular risk factors (n = 1,010), ADVANCE* Study, 2001–2004

<table>
<thead>
<tr>
<th></th>
<th>Women (n = 379)</th>
<th>Men (n = 631)</th>
<th>Total (n = 1,010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean years (SD)*</td>
<td>65.8 (2.8)</td>
<td>65.9 (2.9)</td>
<td>65.8 (2.8)</td>
</tr>
<tr>
<td>Employed part or full time, %</td>
<td>36.4</td>
<td>40.3</td>
<td>38.8</td>
</tr>
<tr>
<td>Married, %</td>
<td>65.2</td>
<td>84.3</td>
<td>77.1</td>
</tr>
<tr>
<td>College graduate, %</td>
<td>20.4</td>
<td>24.8</td>
<td>23.1</td>
</tr>
<tr>
<td>Caucasian, %</td>
<td>67.3</td>
<td>67.7</td>
<td>67.5</td>
</tr>
<tr>
<td>African American, %</td>
<td>6.9</td>
<td>8.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Hispanic, %</td>
<td>6.6</td>
<td>5.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Asian, %</td>
<td>6.3</td>
<td>6.7</td>
<td>6.5</td>
</tr>
<tr>
<td>Other ethnicity, %</td>
<td>12.9</td>
<td>11.3</td>
<td>11.9</td>
</tr>
<tr>
<td>Diabetic, %</td>
<td>11.6</td>
<td>21.9</td>
<td>18.0</td>
</tr>
<tr>
<td>Metabolic syndrome, %</td>
<td>23.7</td>
<td>26.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Current smoker, %</td>
<td>8.2</td>
<td>7.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>56.5</td>
<td>61.3</td>
<td>59.5</td>
</tr>
<tr>
<td>Hyperlipidemia, %</td>
<td>40.6</td>
<td>46.8</td>
<td>44.5</td>
</tr>
<tr>
<td>Body mass index, mean kg/m² (SD)</td>
<td>28.2 (6.2)</td>
<td>28.6 (4.6)</td>
<td>28.4 (5.2)</td>
</tr>
<tr>
<td>Body mass index ≥25, %</td>
<td>63.6</td>
<td>78.1</td>
<td>72.7</td>
</tr>
</tbody>
</table>

* ADVANCE, Atherosclerotic Disease VAscular functioN and genetiC Epidemiology; SD, standard deviation.
A SBAS classification at moderate or greater intensity had a sensitivity of 0.73 and a specificity of 0.61 to detect the national physical activity recommendations of 150 or more minutes/week at moderate or greater intensity, using PAR minutes/week at moderate- or higher-intensity activity (figure 2). The sensitivity and specificity of the SBAS based on gender were similar. SBAS at a moderate or greater intensity had a sensitivity of 0.75 and a specificity of 0.58 to detect recommended physical activity levels in women and a sensitivity of 0.73 and a specificity of 0.64 to detect recommended physical activity levels in men.

**DISCUSSION**

Habitual physical activity of humans is a highly complex behavior, the measurement of which in free-living populations presents a number of challenges. The doubly labeled water technique provides information on total energy expenditure over days or weeks (6, 12, 18), while physiologic and/or motion sensor monitoring can provide information on when activity is performed and an indication of its intensity (15, 16). However, these techniques present substantial logistic challenges for use in large-scale studies where staff and subject/patient time is often limited (10, 11). Thus, physical activity status is frequently determined by some form of self-reported daily log, diary, interview, or self-administered questionnaire. These self-reports have ranged from a single question (how active are you relative to other people your own age) to very extensive interviewer-administered questionnaires (6–9).

Our goal for the SBAS was to have a brief self-reported questionnaire that has adequate accuracy to measure the total amount and intensity of physical activity that a person typically performs. To do this for adults, we felt it best to focus on their current activity and to have them consider separately what they typically do when spending time on the job and what they typically do outside their time spent at an occupation. Their leisure time is typically spent on self-care, household chores, recreation/fitness activities, and transportation. Rather than having respondents rate their activities...
for each of these categories, we thought it best to group them all together as leisure-time activity. In addition, some people will walk to work for both transportation and fitness, and some people consider gardening a household chore while others consider it recreation.

Our primary objectives were to determine the validity of the new two-item SBAS for classifying subjects into five distinct physical activity categories and if the SBAS at a moderate or greater activity level could detect recommended physical activity levels (≥150 minutes/week at moderate or greater intensity) derived from PAR minutes/week. Responses to the self-reported SBAS generally related well to the physical activity profiles obtained using the interviewer-administered PAR and to cardiovascular disease risk biomarkers known to be influenced by habitual physical activity. Thus, this initial evaluation of the SBAS suggests that it could be useful for assessing the current activity status of adults when subject and staff time is limited.

Participants in this study lived in northern California, with a greater percentage of these older adults meeting the recommendations for physical activity (64 percent) than the physical activity estimates of older adults in California during the same time period obtained from the Behavioral Risk Factor Surveillance System (21). These latter physical activity data reported for California in 2003 indicated that approximately 44.5 percent of adults aged 45–65 years and 39.9 percent of adults aged more than 65 years were meeting recommendations for physical activity of 150 or more minutes/week at moderate or greater intensity or 60 minutes/week at vigorous intensity or both. The US physical activity national average for meeting recommended physical activity by age (42.8 percent for 45–65 years, 36.3 percent for >65 years) is somewhat lower than that of California (21) and is approximately 25 percent lower than the data obtained in our sample of older adults. Subjects in our study were fairly active older adults and may not be representative of older adults in the United States. However, consideration needs to be given to potential response bias, with subjects either under- or overreporting their current physical activity. In addition, different measures were used to assess physical activity in the BFRSS and in our study using the SBAS. Further research is recommended, using the SBAS in adults living in other geographic locations, younger adults, and ethnically diverse populations.

To our knowledge, the SBAS is the only brief activity tool that is able to classify subjects into five distinct physical activity levels and can be scored quickly with immediate feedback given to a participant or patient. Several investigators have recently reported development of new brief physical activity assessment tools (22–25). Marshall et al. (23) developed a brief physical activity tool based on recommended guidelines that is able to determine if a person is meeting physical activity recommendations or not and that can be administered and scored quickly. Although this tool is useful for dichotomously classifying persons as active or inactive, observing modest changes in physical activity over time could be troublesome. Wendel-Vos et al. (25) reported on the validity of a short questionnaire to assess health-enhancing physical activity (SQUASH). The tool is able to classify subjects into three different intensity categories—light, moderate, or vigorous. Subjects were able to answer the questions in less than 5 minutes, although scoring of the tool is somewhat complex, requiring a calculator or computer program. The utility of this questionnaire in clinical settings would be limited when immediate feedback to a patient/subject is desired, although the questionnaire seems useful for physical activity surveillance and large epidemiologic studies. The uniqueness of the new two-item SBAS is that it can be administered and scored quickly with immediate feedback given, and it can be used to classify subjects into five distinct levels of total daily physical activity, ranging from inactive to very hard intensity.

The SBAS at a moderate-intensity activity level or greater was able to detect recommended national physical activity recommendations of 150 or more minutes/week at moderate or greater intensity, using PAR minutes/week of moderate or greater intensity activity as the standard. This is an additional strength of the SBAS, that it can reasonably determine if a person is meeting physical activity recommendations or not. In addition, the SBAS was able to significantly discriminate PAR minutes/week, estimated energy expenditure derived from PAR, and cardiovascular disease risk biomarkers associated with physical activity (table 2). The SBAS is the first brief activity tool to report significant associations with cardiovascular disease risk biomarkers, including body mass index, high density lipoprotein cholesterol, triglycerides, fasting glucose and insulin, and metabolic syndrome, although this does not imply that there is a direct relation between SBAS activity classification and disease risk. However, these significant associations do provide initial evidence of concurrent validity for the SBAS.

The SBAS is a valid, brief activity tool that can be used as a screening tool for inclusion/exclusion criteria or when time and staff constraints are limited when assessing physical activity in large-scale epidemiologic studies. In addition, the SBAS can be used in clinical practice settings, readily identifying persons needing physical activity counseling during a regular office visit. The SBAS seemed to function equally well in men and women, although further research studies are needed to determine if gender differences in other populations and age groups exist. In addition, future use of this tool in clinical populations including persons with limited English literacy is needed. However, this new brief activity tool is not without limitations. The SBAS does not provide information on specific activity patterns and instead provides only a global index of activity. In addition, we do not know if the responses are sensitive to change as a result of a meaningful increase or decrease in physical activity.

The PAR was used as our “criterion” measure of physical activity minutes/week to determine if subjects were meeting national recommendations of 150 or more minutes/week at a moderate-intensity level or greater. While the SBAS asks about a person’s usual activity over the past year, the PAR uses the past week as a “snapshot” of the usual activity a person performs, although containing seasonal variations, throughout the year. Overall, data from other studies suggest that the total amount of various intensities of activity for most people does not vary much week to week or month to month, unless there are special circumstances such as going...
on a vacation, being ill, or starting a new activity regimen. In addition, the PAR is not error or bias free, and misclassification by PAR may have contributed to possible error. Thus, the sensitivity and specificity of the SBAS obtained may potentially be lower than what is actually true in the population. Further testing of this tool is needed, including examination of the SBAS stability over time. In addition, the uses of accelerometers or motion sensors and detailed physical activity histories or diaries in conjunction with the SBAS are recommended in further validation studies.

In conclusion, the SBAS provides a quick assessment of the usual amount and intensity of physical activity that a person performs throughout the day. In this initial validation study, the SBAS was able to classify subjects into five different levels of physical activity and to reasonably detect national physical activity recommendations, when compared with PAR minutes/week at a moderate or greater intensity. The SBAS needs further validation in other populations, but it demonstrated the potential of being a reasonably valid and inexpensive tool for quickly assessing habitual physical activity in large-scale epidemiologic studies and clinical practice.

ACKNOWLEDGMENTS

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Preliminary results from this study were presented at the American Heart Association’s 45th Annual Conference on Cardiovascular Disease Epidemiology and Prevention in association with the Council on Nutrition, Physical Activity, and Metabolism, Washington, DC, April 29–May 2, 2005 (26).

Conflict of interest: none declared.

REFERENCES

APPENDIX

Stanford Brief Activity Survey

Instructions (with instruments). This is a self-administered questionnaire that attempts to have the respondent summarize his/her usual physical activity on the job and during leisure time during the past year, on the basis of a single statement for each. Appendix table 1 pertains to on-the-job activity, while Appendix table 2 pertains to leisure-time activity.

Give the questionnaire to the participant and ask him/her to read through the entire questionnaire before answering. Remind the participant that he/she should select the answer that best represents his/her activity during the past year. The participant needs to provide an answer for both on-the-job and leisure-time activity. If not gainfully employed outside the home but works regularly around the house, the participant should include this activity in the on-the-job section.

To the respondent of Appendix table 1: Please check the box next to the one statement that best describes the kinds of physical activity you usually performed while on the job this last year. If you are not gainfully employed outside the home but perform work around the home regularly, indicate that activity in this section.

To the respondent of Appendix table 2: Please check the box next to the one statement that best describes the way you spent your leisure time during most of the last year.

Scoring. Using Appendix figure 1 to illustrate scoring, determine the intersection of the respondent’s on-the-job activity (A–E) response on the vertical axis with his/her leisure-time activity (F–J) response on the horizontal axis to indicate the respondent’s current activity category. Each pattern represents a different activity category.

For example, a person working in an office who mainly sits at a desk all day and rides a bicycle for 30 minutes/day, five times per week, would choose “B” as his/her on-the-job activity and “I” as his/her leisure-time activity. The intersection of these two responses on Appendix figure 1 would place the person in a very hard-intensity activity category (horizontal lines). On the other hand, a person who works full time as a carpenter performing some hard labor during the day and plays golf once a week on the weekends would choose “D” as his/her on-the-job activity and “G” as his/her leisure-time activity. The intersection of these two responses on Appendix figure 1 would place this person in a moderate-intensity activity category (solid white).

APPENDIX TABLE 1. Stanford Brief Activity Survey of on-the-job activity

| A. ☐ | If you have no job or regular work, check box A and go on to Appendix table 2. |
| B. ☐ | I spent most of the day sitting or standing. When I was at work, I did such things as writing, typing, talking on the telephone, assembling small parts, or operating a machine that takes very little exertion or strength. If I drove a car or truck while at work, I did not lift or carry anything for more than a few minutes each day. |
| C. ☐ | I spent most of the day walking or using my hands and arms in work that required moderate exertion. When I was at work, I did such things as delivering mail, patrolling on guard duty, doing mechanical work on automobiles or other large machines, house painting, or operating a machine that requires some moderate-activity work of me. If I drove a truck or lift, my job required me to lift and carry things frequently. |
| D. ☐ | I spent most of the day lifting or carrying heavy objects or moving most of my body in some other way. When I was at work, I did such things as stacking cargo or inventory, handling parts or materials, or doing work like that of a carpenter who builds structures or a gardener who does most of the work without machines. |
| E. ☐ | I spent most of the day doing hard physical labor. When I was at work, I did such things as digging or chopping with heavy tools or carrying heavy loads (bricks, for example) to the place where they were to be used. If I drove a truck or operated equipment, my job also required me to do hard physical work most of the day with only short breaks. |

APPENDIX TABLE 2. Stanford Brief Activity Survey of leisure-time activity

| F. ☐ | Most of my leisure time was spent without very much physical activity. I mostly did things like watching television, reading, or playing cards. If I did anything else, it was likely to be light chores around the house or yard or some easy-going game like bowling or catch. Only occasionally, no more than once or twice a month, did I do anything more vigorous, like jogging, playing tennis, or active gardening. |
| G. ☐ | Weekdays, when I got home from work, I did few active things, but most weekends I was able to get outdoors for some light exercise—going for walks, playing a round of golf (without motorized carts), or doing some active chores around the house. |
| H. ☐ | Three times per week, on average, I engaged in some moderate activity, such as brisk walking or slow jogging, swimming, or riding a bike for 15–20 minutes or more, or I spent 45 minutes to an hour or more doing moderately difficult chores, such as raking or washing windows, mowing the lawn or vacuuming, or playing games such as doubles tennis or basketball. |
| I. ☐ | During my leisure time over the past year, I engaged in a regular program of physical fitness involving some kind of heavy physical activity at least three times per week. Examples of heavy physical activity are jogging, running, or riding fast on a bicycle for 30 minutes or more; heavy gardening or other chores for an hour or more; active games or sports such as handball or tennis for an hour or more; or a regular program involving calisthenics and jogging or the equivalent for 30 minutes or more. |
| J. ☐ | Over the past year, I engaged in a regular program of physical fitness along the lines described in the last paragraph (I), but I did it almost daily—five or more times per week. |

(Appendix figure 1 follows)
APPENDIX FIGURE 1. Illustration of scoring in the Stanford Brief Activity Survey. Activity categories are represented by different patterns, as follows: inactive = vertical lines, light-intensity activity = trellis pattern, moderate-intensity activity = solid white, hard-intensity activity = solid black, and very hard-intensity activity = horizontal lines. Refer to Appendix tables 1 and 2 for explanations of A–E and F–J, respectively.