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Occupational Physical Activity: Reliability and Comparison of Activity Levels

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Background: In 2001, the Behavioral Risk Factor Surveillance System (BRFSS) included a new occupational physical activity (PA) question. This article evaluates the reliability of this survey question. *Methods*: Forty-six subjects were followed for 3 wk, answered 3 PA surveys by telephone, and completed daily PA logs for 1 wk. Kappa statistics determined the reliability of occupational activities (sitting/standing, walking, and heavy lifting). A descriptive analysis compared the time in specific occupational activities. *Results*: Eighty percent of the respondents reported "mostly sitting or standing" at work; and test–retest reliability was moderate ($k = 0.40$ to 0.45). The occupationally inactive sat/stood for 85% (mean hours = 5.6) of the workday, whereas the occupationally active sat/stood for 53% (mean hours = 3.9) of the workday. *Conclusions*: The BRFSS occupational activity question has moderate reliability, distinguishes between occupationally active and inactive persons, and can be used in surveillance systems to estimate adult occupational PA.

Key Words: exercise, survey, validation

Moderate-intensity physical activity (PA), such as brisk walking, is associated with health benefits.[1] Moderate PA is typically achieved through leisure-time pursuits; however, some occupations involve high levels of activity during the course of the day.[2] Moderate-intensity, muscle-strengthening, and flexibility-enhancing activities accrued in one's occupation might contribute appreciably to a person's overall activity level, and consequently could promote health. Research studies have noted a relationship between increased occupational PA levels and a decreased risk of coronary heart disease,[3,4] fatal heart attack,[5,6] lower cholesterol levels,[7] higher aerobic capacity,[8] lower body fat,[8] greater muscular flexibility,[8] and lower rates of colon cancer.[9-11]

Analysis of only leisure-time PA might underestimate a person's total level of PA. Furthermore, excluding occupational PA from analytic studies could confound the relationship between PA and mortality.[12] A comprehensive assessment of PA, including both occupational and nonoccupational (leisure time, household,

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and transportation) activities, is important for epidemiologic studies of PA and health outcomes.

Although occupational PA might contribute to overall health and wellness, it had not been routinely quantified in health surveys for state use until 2001, when new comprehensive PA questions designed to assess occupational (1 question) and nonoccupational (6 questions) physical activity were added to the Behavioral Risk Factor Surveillance System (BRFSS PA module).[13] The BRFSS, conducted on an annual basis by the Centers for Disease Control and Prevention and by state public health departments, is a telephone survey of the health behaviors and chronic health conditions of the US population.[13] The primary objectives of this article are to provide a descriptive analysis and to determine the reliability of the BRFSS occupational PA question.

Methods

The BRFSS Physical Activity Survey (BPAS) was conducted at the University of South Carolina (USC) from September 2000 through May 2001 to assess the reliability and validity of all questions in the new BRFSS PA module. Participants were followed for 3 wk, during which they answered a PA survey three times by telephone, twice during the first week (surveys 1 and 2) and once during the third week (survey 3). The participants also completed a daily PA log during the second week of the study (see Figure 1).

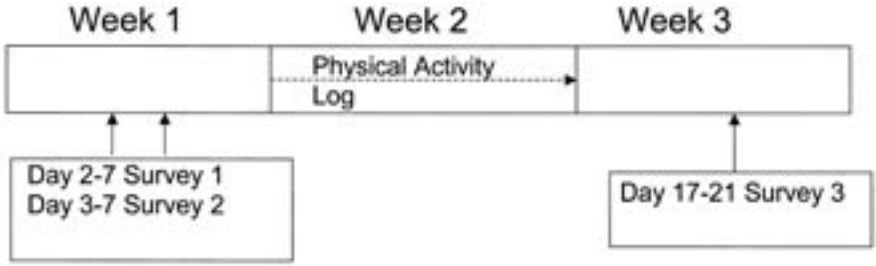

Figure 1—Timeline of study.

Study Participants

Study participants were a convenience sample of adult men and women, recruited at USC and in the Columbia, SC metropolitan area. Recruitment was done by word of mouth and by posting flyers on the USC campus and in community centers, cafes, and shopping centers. The flyers stated that USC was seeking adults age 18 and over for a study of physical activity habits. Participants would receive free height and weight measurements, a detailed profile of their PA, and a financial incentive of $25 that was given at the conclusion of the study. A total of 60 participants were recruited into the study, with all completing the required tasks. All participants signed an informed consent form, and the research was approved by the USC Institutional Review Board for Protection of Human Subjects in Research.

Because the objective of this article was to analyze the occupational activity question, only the subset of participants who were employed and completed activity

logs were included in the final study sample. Specific information regarding type of employment was not collected. Fourteen respondents were excluded for the following reasons: seven were not employed, five were employed but did not fill out the log, one indicated only "other" occupational activity, and one had an incomplete log, with a total of 15 min of activity. The final sample size was 46 respondents (78% of the total) who were both employed and completed an activity log.

Questionnaire and Log

The participants were asked questions about PA in a short survey, which takes approximately 2 min to complete. The occupational PA question was asked first, followed by a series of moderate and vigorous PA questions. Occupational physical activity was categorized using the following question, "When you are at work, which of the following best describes what you do? Would you say: (a) mostly sitting or standing, (b) mostly walking, or (c) mostly heavy lifting or physically demanding work." Those who were unemployed, retired, or did not work for pay did not answer this question. The participants also answered 6 questions regarding frequency (d/wk) and duration (min/d) of moderate and vigorous nonoccupational physical activity in a usual week.[14] A previous study found these nonoccupational PA questions to have good reliability.[15]

To compare the survey responses concurrently with an independent measure of PA, the participants completed PA logs[16] indicating total daily duration (hours and minutes) of occupational activities and nonoccupational activities. The occupational activities in the log were sitting, standing, walking, lifting or carrying 10 to 20 lbs at work, lifting or carrying 20+ lbs at work, and other (with a space to write in the activity). One subject indicated work in "other" occupational activity only, but did not provide details of the activity and was excluded from further analysis. The nonoccupational activities in the log included household (e.g., gardening, sweeping), transportation (e.g., walking to/from work), conditioning (e.g., bicycling, jogging), sports (e.g., baseball, soccer), and leisure (e.g., bowling, dance) activities. Logs were to be completed daily during the second week of the study (see Figure 1). Participants were instructed to complete the logs at the end of the day, and to write the hours and minutes spent doing an activity and the time the activity began. If an activity was done more than once in a day, the subject wrote the total time spent in the activity.

Data Analysis

Reliability was evaluated three times: survey 1 versus 2, survey 1 versus 3, and survey 2 versus 3. Kappa statistics[17] comparing the category of occupation reported (mostly sitting/standing, mostly walking, or mostly heavy lifting) were used to evaluate test–retest reliability of the occupational PA question when measured over multiple surveys. Results were classified according to the categories described by Landis & Koch:[17] almost perfect agreement (k = 1.0 to 0.8), substantial (k = 0.8 to 0.6), moderate (k = 0.6 to 0.4), fair (k = 0.4 to 0.2), and poor (k = 0.2 to 0.0). Intra-class correlation coefficients were also calculated; however, the results were the same as the kappa analysis and are not shown. The analysis assumes that the respondent's job remained the same throughout the study period. SAS version 8.02 (SAS Institute, Inc., Cary, NC) was used for data analysis.

Occupational activity, as reported on the daily PA logs, was averaged over the number of reported work days to create a measure of average working minutes per day (total hours and minutes per day, divided by the number of days of reported activity) of occupational sitting/standing, walking, or heavy lifting. Because participants had a wide range of workday lengths, the percentage of daily work hours per occupational activity was also calculated. Responses from the two PA log categories for lifting and carrying at work were combined to match the occupational PA survey question response of "mostly heavy lifting or physically demanding work." Nonoccupational activity was computed in the same manner to create an average minutes per day of nonoccupational activity.

Participants were classified as occupationally inactive (mostly sitting or standing) or active (mostly walking or heavy lifting) according to their responses on the PA survey. The percentage of daily work hours per occupational activity type and mean reported hours of occupational activity in the three occupational PA categories (sitting/standing, walking, lifting) reported in the PA log were compared among the active and inactive groups. Analysis of variance (ANOVA) was used to determine whether there was a difference in the mean reported hours of type of occupational activity among the active and inactive groups. F-statistics with $P \leq 0.05$ indicated significant differences between the groups. To assess the proportion of total PA that was done at work, the percentage of average daily minutes of occupational (walking and heavy lifting) and nonoccupational PA reported in the activity log was stratified by active or inactive at work.

Results

The study sample was 25 men (age 39.5 ± 13 y) and 20 women (age 45 ± 15 y); Table 1. The sample was predominantly overweight or obese (73%), college educated (96%), white (82%), and lived in an urban area with ≥ 30,000 persons (89%).

Approximately 80% of the sample reported "mostly sitting or standing" at work on each of the PA surveys (Table 2). In surveys 1 and 2, 1 person reported doing occupational heavy lifting and 4 people reported this PA level in survey 3. A different number of respondents answered the occupational activity question each time the survey was administered; $n = 39$ on the first survey and $n = 43$ on the third survey.

There was perfect agreement ($k = 1.0$) when survey 1 was compared with survey 2, which were administered within 1 wk (Table 3). Kappas, however, were moderate ($k = 0.40$; percent agreement = 81%) when survey 1 was compared with survey 3, given 3 wk after the first survey, and when survey 2 was compared with survey 3 ($k = 0.45$; percent agreement = 82%). Sixty-seven percent ($n = 30$) of the respondents answered the same occupational category on each of the three surveys.

Those who were occupationally inactive ($n = 33$) sat or stood for 84.9% of the workday (an average of 5.6 h), walked 13.4% (1.0 h), and lifted heavy objects for 1.7% of the day (0.5 h) (data not shown). In comparison, those who were occupationally active ($n = 6$) sat or stood for 53% of the workday (an average of 3.9 h), walked 32.8% (2.1 h), and lifted heavy objects 14.2% of the workday (4.2 h). The average hours reported in occupational walking and lifting were significantly different between the active and inactive occupational classifications (walking: $F = 8.01$, $P = 0.008$; lifting: $F = 4.84$, $P = 0.05$). Those with inactive occupations

Table 1 Demographics of Study Participants

Demographic	Men	Women	Total
N	25 (55.6%)	20 (44.4%)	45
Mean age (± SD)	39.5 (13.2)	44.8 (14.6)	41.8 (13.9)
Body-mass index (kg/m^2)			
Normal (18-24.9)	4 (16.0%)	8 (40.0%)	12 (26.7%)
Overweight (25.0-29.9)	13 (52.0%)	8 (40.0%)	21 (46.7%)
Obese (≥ 30.0)	8 (32.0%)	4 (20.0%)	12 (26.7%)
Educational level			
Some college/college	23 (92.0%)	20 (100.0%)	43 (95.6%)
High school or less	2 (8.0%)	0 (0.0%)	2 (4.4%)
Race/ethnicity			
Non-Hispanic white	22 (88.0%)	15 (75.0%)	37 (82.2%)
African American	3 (12.0%)	5 (25.0%)	8 (17.8%)
Income			
< $25,000	4 (16%)	2 (10%)	6 (13%)
$25,000 – $49,999	10 (40%)	7 (35%)	17 (38%)
$50,000 – $74,999	5 (20%)	3 (15%)	8 (18%)
$75,000 +	5 (10%)	7 (35%)	12 (27%)
Missing	1 (4%)	1 (5%)	2 (4%)
Marital status			
Single	10 (40.0%)	5 (25.0%)	15 (33.3%)
Married/living with someone	12 (48.0%)	11 (55.0%)	23 (51.1%)
Divorced/widowed	3 (12.0%)	4 (20.0%)	7 (15.6%)
Urban (%)	22 (88.0%)	18 (90.0%)	40 (88.9%)

Table 2 Occupational Physical Activity Classification by Survey Administration

	Survey administration		
	1	2	3
Occupational Physical Activity Classification	*n* = 39	*n* = 40	*n* = 43
Mostly sitting/standing	33 (84.6%)	33 (82.5%)	34 (79.1%)
Mostly walking	5 (12.8%)	6 (15.0%)	5 (11.6%)
Mostly heavy lifting	1 (2.6%)	1 (2.5%)	4 (9.3%)

Table 3 Reliability of Occupational Physical Activity Classification by Survey Administration

	Interval between surveys	Kappa	% agreement
Survey 1 – Survey 2	1 – 5 d	1.0	100
Survey 2 – Survey 3	10 – 18 d	0.45	82
Survey 1 – Survey 3	10 – 19 d	0.40	81

obtained 30% of their daily total PA while at work; those with active occupations obtained 47% of their daily PA while at work. The responses from the first survey were used for this analysis, but results were similar when other survey administrations were used.

Conclusions

The occupational PA survey question had moderate reliability (k = 0.40 to 0.45) over multiple survey administrations, distinguished between inactive and active occupational levels, and provided stable estimates of each PA level. Kappa was perfect (k = 1.0) when comparing surveys taken within 1 wk. These reliability results are consistent with results from previous studies of occupational physical activity.[18,19] Respondents in active occupations reported an average of 1 h more per day walking at work than did the respondents in inactive occupations and also reported an average 3 more hours of heavy lifting. Furthermore, those working in active occupations performed almost half of their total daily PA while at work.

The decrease in kappa from k = 1.0 comparing surveys 1 and 2 taken within a week, to k = 0.40 when the first survey was compared with a survey given 3 wk later is not surprising, given the small sample size and potential instability of the measure. Multiple survey administrations within 1 wk would likely have a greater number of concordant responses than surveys taken 3 wk apart for people whose occupational PA levels do not clearly fit into 1 category. The active people in our sample spent on average only 47% of their work time in walking and lifting activities. Occupationally active people who perceive spending approximately half of their time walking at work could have difficulty choosing between the "mostly sitting or standing" and "mostly walking" responses and be more likely to change their responses on future surveys. Similarly, those who perform some but spend less than half of their work time doing lifting activities could have difficulty choosing between "mostly heavy labor or physically demanding work" and another category. There were similar proportions of each PA level in all survey administrations, however, and 80% agreement between survey 1 and later administrations. Therefore the individual variability seems to have minimal effect on prevalence estimates, and the occupational PA survey question appears to work well at the group level.

In a study of 79 adult men and women surveyed for their PA levels at work using the Tecumseh Self-Administered Occupational Questionnaire, Ainsworth et al.[19] found that 90% of occupational PA was in light-intensity activities (sitting, standing, and walking). The study reported here found similar results; approximately 80% of the study participants reported mostly sitting/standing activities and 12 to 15% reported mostly walking activities on the PA survey occupational question. Answers to the occupational PA survey question were compared with PA logs completed by the study participants each night. The study participants were instructed to report bouts of activity ≥ 10 min on the PA log; however, occupational walking might have been at a low-intensity level and several respondents reported activity of less than 10 min duration (which was included in the analysis). With this caveat, subjects in active occupations reported walking or heavy lifting an average of 2 to 4 h/d at work. Although the PA recommendations are based on measures that exclude occupational PA,[20] occupational PA contributes to an active lifestyle and thus could incur positive health benefits.[3-7]

Whereas the findings show moderate reliability for the BRFSS occupational questions, the study reported here has several limitations. First, the sample size was very small, especially in the heavy lifting occupational category that included only a few people. This study, however, was not designed to evaluate only the occupational PA question, rather the entire new BRFSS PA module. Despite the small sample size, the reliability was moderate or better. A second limitation is the lack of generalizeability, because the sample was comprised of only white or African American persons with high education and income levels. These results might vary in a different socioeconomic group or among people employed in more physically active occupations. Additional studies are needed to evaluate the occupational activity classifications in a more diverse group of people. Finally, using a PA log to record activities at the end of the day has inherent recall bias, because participants might not recall exactly what activities they did during the day or the duration of the activities. Objective measures of activity were not used in this analysis. The data indicate, however, that the occupational PA question does categorize respondents according to their occupational activity level, and a previous validation study has shown moderate correlation between the PA log and questionnaire.[16]

This single question, as used in the BRFSS PA module, provides a snapshot of occupational PA on a state and national level. This study showed that occupationally active persons could accumulate a significant proportion of total daily PA at work, highlighting the need to assess occupational PA. Because the question was designed to assess a general level of activity, the details of frequency, duration, intensity, or contexts of the occupational activity are not measured, and the question is not detailed enough to combine mathematically with questions that measure other domains of PA with more accuracy. Nonetheless, using the occupational PA question in conjunction with other PA measures can better describe a person's total level of PA.[21]

The study reported here is the first to evaluate the reliability of the BRFSS occupational PA question, which is administered every odd-numbered year to > 200,000 US residents to obtain a snapshot of the nation's health. This occupational activity question from the BRFSS PA module has moderate reliability, differentiates between occupational PA levels, is a simple construct to measure occupational PA, and is a single item that can be easily used in surveillance studies to obtain an overview of adult occupational PA. Including an occupational PA question on surveys that assess leisure-time or household activity levels is valuable to PA surveillance because together they present a more comprehensive picture of overall activity levels.

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