Reliability and Convergent Validity of the National College Health Risk Behavior Survey Physical Activity Items

Mary K. Dinger

ABSTRACT

This study examined the reliability and validity of the National College Health Risk Behavior Survey (NCHRBS) vigorous physical activity (VPA), moderate physical activity (MPA), flexibility (FLEX), and muscular strength and/or endurance (MSE) questions. Twenty college students completed the four items twice during the same day. During the next 7 days they wore an accelerometer and a pedometer during all waking hours. They also recorded their daily activity in a log. At the end of the week, subjects completed the NCHRBS physical activity items again. The intraclass correlation coefficients ranged from .94–.99 for the four items. The vigorous item was highly correlated with log VPA ($r=.82$) and number of days with $\geq 20$ minutes of VPA from the accelerometer ($r=.60$). The flexibility item was moderately correlated ($r=.57$) and the muscular strength and/or endurance item was highly correlated ($r=.89$) with corresponding log activities. The moderate item was highly correlated with log MPA ($r=.66$) and number of days with $\geq 30$ minutes of MPA from the accelerometer ($r=.61$). In conclusion, the NCHRBS physical activity items have excellent test-retest reliability and validity indices similar to other self-report physical activity questions.
survey: physical inactivity, tobacco use, alcohol and other drug use, high-risk sexual activity, dietary consumption, and unintentional and intentional injuries (Kolbe et al., 1993).

The physical activity questions from the NCHRBS have been used widely to describe physical activity among college students (Centers for Disease Control and Prevention, 1997; Dinger, 1999; Dinger & Waigandt, 1997), but the reliability and validity of these questions have not been determined (Brener, Collins, Kann, Warren, & Williams, 1995). The purpose of this study was to examine the reliability and validity of the NCHRBS vigorous physical activity (VPA), moderate physical activity (MPA), flexibility activity (FLEX), and muscular strength and/or endurance activity (MSE) items.

METHODS

Subjects
A power calculation was conducted before the study began to determine the necessary number of subjects. The researcher reviewed the literature and determined that a Pearson correlation coefficient of .55 between the physical activity questions and direct measures of physical activity would be meaningful. According to Kraemer and Thiemann (1987) at least 19 subjects were needed (80% power, one-tailed test, alpha=.05).

Twenty college students were recruited and volunteered to participate in the study. There were 9 women (age: 24.1±3.5 years, body mass index (BMI): 27.9±6.4) and 11 men (age: 24.0±3.2 years, BMI: 26.4±3.9). All subjects were academically classified as seniors.

Design
A correlational design was employed. Student responses to the four physical activity items were correlated with number of days of VPA, number of days of MPA, number of steps, and activity log data to examine the validity of the items.

Measures
Physical activity can be assessed using indirect or direct methods. Indirect methods are surrogate markers of physical activity, and direct methods reflect actual movement and/or energy expenditure (Ainsworth, 2000). Whereas surveys are indirect measures of physical activity, accelerometers, pedometers, and activity logs are considered to be direct, quantitative measures of physical activity. Therefore, these measures are used to validate physical activity surveys and other subjective physical activity measures (Ainsworth, 2000). To triangulate the findings, three direct measures of physical activity (accelerometers, pedometers, and activity logs) were used as direct criterion measures in this study.

NCHRBS Physical Activity Items. These items require subjects to report their participation in VPA, MPA, FLEX, and MSE during the previous 7 days. The original MPA question from the 1995 NCHRBS was assessed along with the revised MPA item from the 2000 Youth Risk Behavior Survey. These items are presented in Figure 1.

Computer Science and Applications
Actigraph Accelerometer. The Actigraph (model 7164) accelerometer is a small, lightweight, personal physical activity measurement and recording system (Computer Science and Applications, 1999) that was used as one direct criterion measure of subjects’ ambulatory physical activity in this study. Accelerometers detect motion produced by a change in the speed or pattern of bodily movements. The Actigraph allows for continuous collection (1-minute intervals) and storage of data for up to 22 days. The stored data can be downloaded via interface to a personal computer for analysis. Actigraph data are in counts per unit time and represent the level or intensity of the activity during each time period. Several studies have reported that Actigraph counts are significantly correlated with energy expenditure and relative oxygen consumption (Hendelman, Miller, Baggett, Debold, & Freedson, 2000; Melanson & Freedson, 1995; Welk, Blair, Wood, Jones, & Thompson, 2000). The Actigraphs used in this study were approximately 1 month old and had calibration checks completed prior to being shipped from the manufacturer.

Yamax Digiwalker Pedometer. The Yamax Digiwalker (DW; model 200) was the pedometer used as the second direct criterion measure of ambulatory physical activity. This pedometer is the most accurate pedometer available to assess ambulatory physical activity (Bassett et al., 1996). The DW counts the number of steps an individual takes by vertically displacing a lever arm inside the unit that rotates a counting device (Ainsworth, 2000).

Physical Activity Log. A physical activity log was the third direct criterion measure of physical activity in this study. The physical activity log required subjects to record their participation in VPA, MPA, MSE, and FLEX each day. Subjects recorded whether they participated in each of the four types of activities and identified the specific activity and duration.

Procedures
Following approval by the Institutional Review Board, undergraduate college students were recruited to participate in the study. Fliers were posted at high-traffic areas around campus, an advertisement was placed on the campus television station, and the researcher announced the opportunity in several undergraduate classes. Interested students were instructed to call the researcher for an appointment. An appointment time was established for each subject to come to the laboratory for an orientation session.

At the beginning of the orientation session subjects completed an informed consent, a short demographic questionnaire, and the NCHRBS physical activity items. Next, the researcher weighed each subject using a physician’s beam scale and assessed each subjects’ height using a wall mounted stadiometer.

During the middle portion of the orientation session, each subject was fitted with a cotton belt that fit closely around his or her waist. The belts were used to attach the Actigraph (which was in the nylon pouch available from the manufacturer) to the body, so that the Actigraph could be worn under clothing and fit snugly against
In the analyses. Data from all 20 subjects met these criteria. Cut-points were used to determine the number of days with ≥20 minutes of VPA and the number of days with ≥30 minutes of MPA from the Actigraph data (Freedson, Melanson, & Sirard, 1998).

### Figures

**Figure 1. National College Health Risk Behavior Survey (NCHRBS) Physical Activity Items**

<table>
<thead>
<tr>
<th>Vigorous Item – “On how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?”</th>
</tr>
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<tbody>
<tr>
<td>Flexibility Item – “On how many of the past 7 days did you do stretching exercises, such as toe touching, knee bending, or leg stretching?”</td>
</tr>
<tr>
<td>Muscular Strength/Endurance Item – “On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?”</td>
</tr>
<tr>
<td>Moderate Item 2000 – “On how many of the past 7 days did you participate in physical activity for at least 30 minutes that did NOT make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors?”</td>
</tr>
<tr>
<td>Moderate Item 1995 – “On how many of the past 7 days did you walk or bicycle for at least 30 minutes at a time? (Include walking or bicycling to and from class or work.)”</td>
</tr>
</tbody>
</table>

Note: Possible responses for each item are 0 days – 7 days.
recalled their activity for the same reference week. This design controls for the weekly variability in physical activity and allows for a more accurate assessment of instrument reliability. ICCs in this study were very high, ranging from .94–.99. This indicates that the physical activity items are reliable.

Although the validity of the NCHRBS physical activity items has not been previously assessed, there are other physical activity questionnaires in the literature that require subjects to recall their participation in physical activity during the previous 7 days. Several researchers have explored the validity of the 7-day physical activity recall (PAR) using activity logs as the physical activity criterion measure. Reported correlation coefficients between PAR physical activity and activity recorded in logs range from .39–.82 (Dishman & Steinhardt, 1988; Taylor et al., 1984). The correlations between the NCHRBS physical activity items and log activity found in this study are slightly higher (.49–.89).

Researchers have also examined the validity of physical activity questionnaires using a Caltrac accelerometer as the criterion measure (Miller, Freedson, & Kline, 1994). The correlations between the Actigraph accelerometer and the VPA item \( r = .60 \) or MPA item \( r = .61 \) in this study are higher than those reported between the Caltrac and Godin Leisure-Time Exercise Questionnaire \( r = .45 \) and lower than those reported between the Caltrac and PAR \( r = .79 \).

The current moderate physical activity recommendation states that all adults should accumulate 30 minutes or more of moderate intensity physical activity on most, preferably all, days of the week (Pate et al., 1995). The revised MPA item (2000) reflects this recommendation by including a variety of activities and distinguishes MPA from VPA better than the original MPA item (1995). In addition, the revised MPA item had slightly higher correlations with the Actigraph, DW, and log than the original MPA item (Figure 1 and Table 2).

The low correlation coefficients for the MSE and FLEX items with Actigraph and DW are not surprising. Both the Actigraph and DW are waist-worn devices that measure ambulatory physical activity only; therefore, we did not expect them to capture participation in MSE and FLEX activities. MSE and FLEX activities often require that an individual’s trunk remain stationary throughout the activity, while the arms and legs move. The correlations for these two items and their respective log activity indicate that the items accurately assess students’ participation in these activities.

Physical inactivity is a major health issue among college students. The results of this study indicate that the NCHRBS VPA, MPA, FLEX, and MSE items have excellent test-retest reliability and validity indices similar to other self-report physical activity questions. Therefore, health promotion professionals can confidently use these items to assess college students’ participation in physical activity.

### REFERENCES


Brener, N., Collins, J., Kann, L., Warren, C.,


