ORIGINAL ARTICLE

Reliability of the 1999 Youth Risk Behavior Survey Questionnaire

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Purpose: **To assess the test-retest reliability of the 1999 Youth Risk Behavior Survey (YRBS) questionnaire.**

Methods: **A sample of 4619 male and female high school students from white, black, Hispanic, and other racial/ethnic groups completed the YRBS questionnaire on two occasions approximately two weeks apart. The questionnaire assesses a broad range of health risk behaviors. This study used a protocol that maintained anonymity yet allowed matching of Time-1 and Time-2 responses. The authors computed a kappa statistic for the 72 items measuring health risk behaviors, and compared group prevalence estimates at the two testing occasions.**

Results: **Kappas ranged from 23.6% to 90.5%, with a mean of 60.7% and a median of 60.0%. Kappas did not differ by gender, grade, or race/ethnicity of the respondent. About one in five items (22.2%) had significantly different prevalence estimates at Time 1 vs. Time 2. Ten items, or 13.9%, had both kappas below 61% and significantly different Time-1 and Time-2 prevalence estimates.**

Conclusions: **Overall, students appeared to report health risk behaviors reliably over time, but several items need to be examined further to determine whether they should be revised or deleted in future versions of the YRBS.**

The Youth Risk Behavior Surveillance System (YRBSS) was developed in 1989 by the Centers for Disease Control and Prevention (CDC) to monitor health risk behaviors that contribute to the leading causes of mortality, morbidity, and social problems among youth and adults in the United States. The YRBSS monitors six categories of behaviors: (a) those that contribute to unintentional injuries and violence; (b) tobacco use; (c) alcohol and other drug use; (d) sexual behaviors that contribute to unintended pregnancy and sexually transmitted disease, including human immunodeficiency virus infection; (e) dietary behaviors; and (f) physical activity.

The YRBSS consists of national, state, and local school-based surveys of representative samples of students in grades 9 through 12, a national household-based survey of 12- through 21-year-olds, a national survey of college students, a national survey of alternative school students, and other surveys of special populations of young people. These surveys all use a similar instrument, the Youth Risk Behavior Survey (YRBS) questionnaire, which was developed with extensive research and testing [1].

Data from the YRBSS are used to develop policies and programs to prevent health risk behaviors among youth [2]. It is important, therefore, to have confidence in the reliability of these data. Studies of other measures have demonstrated the reliability of adolescent self-report of tobacco, alcohol, and other

drug use [3,4]; sexual behavior [5]; suicide attempts [6]; dietary behaviors [7,8]; and physical activity [8–10]. In addition, a recent study by Klein et al. examined the reliability of many YRBS items [11]. These studies, however, were limited by small sample sizes and, in most cases, by a lack of diversity within those samples. Further, with the exception of the study by Klein et al., none of these studies assessed the reliability of all categories of health risk behavior. Such an assessment would allow for between-category comparisons.

In 1992, CDC conducted a test-retest reliability study of the original YRBS questionnaire [12]. That study was the first to demonstrate the test-retest reliability of all categories of health risk behavior among a diverse sample of adolescents. The study found that nearly three-quarters of the questionnaire items had "substantial" or higher reliability, according to the categories suggested by Landis and Koch [13]. In addition, the study found that the responses of seventh-grade students were less consistent than those of students in higher grades.

Over the past decade, CDC has modified the YRBS questionnaire to meet federal needs and those of the state and local health and education agencies that conduct the surveys in their jurisdictions. These modifications have included the addition of new questions, as well as changes in the wording of original questions. Because of these modifications, it has become desirable to conduct a reliability study of the updated questionnaire. The present study, therefore, assessed the test-retest reliability of that questionnaire on a large and diverse sample of high school students.

Methods

Sample

A convenience sample of respondents was drawn from 61 schools in 20 states plus the District of Columbia. Because the goal of sampling was to obtain a diverse group of respondents, the 20 states were geographically dispersed. In addition, 48% of the schools in the sample were in urban areas, 39% were in suburban areas, and 13% were in rural areas [14]. Selection of ninth- through 12th-grade classes within each volunteer school varied according to the school's schedule. In about half of the schools, students in health education or physical education classes were eligible to participate. In about one-quarter of schools, students in required academic subjects (e.g., English) were eligible to participate. In

Table 1. Demographic Characteristics of Respondents and of Students in Grades 9 Through 12 Nationwide

Characteristic	Sample Distribution (%)	National Distribution* (%)
Gender		
Male	46.6	51.0
Female	53.4	49.9
Grade		
9	30.6	25.7
10	31.8	25.7
11	21.9	24.5
12	15.7	24.1
Race or ethnicity		
White	52.2	64.8
Black	31.4	12.1
Hispanic	6.1	13.3
Other	10.3	N/A
Age (yrs)		
13	0.1	1.4
14	12.4	17.4
15	28.9	24.0
16	28.5	24.5
17	21.2	22.3
18	8.9	6.7

*Source: U.S. Bureau of the Census [15].

other schools, all students were eligible to participate. In each school, local parental consent procedures were followed. This study was approved by CDC's Institutional Review Board.

Of the 6802 students enrolled in the selected classes, 5216 (77%) completed questionnaires during the first survey administration. The remaining 23% were absent on the day of the survey, failed to return a parental consent form, or, to a much lesser extent, refused to participate or had parents who refused to have their child participate. Of those who completed questionnaires in the first administration, 4628 (89%) completed questionnaires during the second administration. Nine students did not have matching identification numbers on Time-1 and Time-2 questionnaires. The final sample, therefore, consisted of 4619 students.

As shown in Table 1, the demographic characteristics of the sample were similar to the national distribution of ninth- through 12th-grade students [15]. For some groups, the sample percentage differed from the national percentage by more than five percentage points. Specifically, 10th-grade students were overrepresented and twelfth-grade students were underrepresented. In addition, white students and Hispanic students were underrepresented, but black students were overrepresented.

Questionnaire

As part of a larger study designed to test the reliability of all of the items and the effect of alternative question wording for some items, eight very similar forms of the questionnaire were developed. All questionnaires were self-administered and consisted of between 97 and 100 multiple-choice questions. Five questions measured demographic information, two asked students to report their height and weight, and the remaining items assessed health risk behaviors. The questionnaires were identical to the instrument used in the 1999 national YRBS, except for three alternatively worded questions on certain forms, and five questions not on previous versions of the YRBS. The results related to the alternatively worded and new questions are beyond the scope of this article.

Data collection began in February 2000 and was completed in April 2000. The questionnaire was administered in a regular classroom setting and took students about 40 minutes to complete. A standard computer-scannable questionnaire booklet contained the questions and was used to record responses. As with the standard YRBS, no skip patterns were included in the questionnaire. This technique helps to safeguard privacy because comparable amounts of time are required to complete the questionnaire regardless of risk behavior status, and because students cannot detect the risk behaviors of other students simply by looking at the pattern of responses.

Data Collection Procedures

Before the first survey administration, a unique number was assigned to two scannable questionnaire booklets. Each set of two identically numbered booklets was placed in an envelope. During the administration of the first survey, students removed and used one booklet. The envelope, now containing only the second booklet, was then sealed by the student, who wrote his or her name across the seal. During the second survey administration, each student received the envelope with his or her name across the seal. After removing and completing the second booklet, the student destroyed the envelope. This technique has been used successfully in previous studies, and students perceive that it adequately safeguards their privacy [12,16].

The survey was conducted by trained data collectors from Macro International Inc. (ORC Macro). The data collectors read aloud scripts that explained the survey procedures. Students were informed during the first survey administration that they would be asked to complete a "very similar" questionnaire a few weeks later. Other than that variation, the administration procedures used in this study were the same as those used for the standard YRBS.

For 57% of the schools, the first and second administrations of the survey were exactly 14 days apart. The first and second survey administrations in the remaining schools ranged from 10 to 22 days, with an average span of 15.6 days.

Data Analysis

Collapsing and editing procedures. After the questionnaire booklets were cut and scanned, the data were edited for inconsistency according to standard YRBSS procedures. These procedures exclude questionnaires that do not have more than 20 valid responses or have the same response option 15 or more times in a row. Although many questions contain multiple response categories, standard YRBSS reports dichotomize responses into "no risk" vs. "at risk." For example, students who responded that they carried a weapon on 0 of the past 30 days are classified as "no risk," whereas those who reported that they carried a weapon on 1 or more of the past 30 days are classified as "at risk." Because we wanted to examine how the data perform in standard YRBSS reports, these same procedures were followed for the analyses reported here.

Fourteen items using "the last time" and "in the past 7 days" as the reference period could not be expected to be consistent across a 2-week timeframe and were eliminated from the analysis. In addition, the five questions not on previous or current versions of the YRBS questionnaire were eliminated from the analyses for this study.

Kappa statistic and prevalence rates. A kappa statistic, which provides a measure of agreement that corrects for what would be expected by chance, was computed for each of the 72 items. Prevalence rates for each risk behavior at Time 1 and Time 2 also were calculated. These rates were considered significantly different if their 95% confidence intervals (CIs) did not overlap. This is the same criterion used in assessing the statistical significance of subgroup differences in reports of YRBSS data [17].

Results

Kappas ranged from 23.6% to 90.5%, with a mean of 60.7% and a median of 60.0% (Table 2). Using qual-

Table 2. Kappa Statistics, Time-1, and Time-2 Prevalence Rates, by Questionnaire Item

Item	Kappas (%)	Time 1 (%)	Time 2 (%)
Behaviors related to unintentional injuries and violence			
Rarely or never wear helmet when riding a motorcycle	66.1	37.8	46.8*
Rarely or never wear helmet when riding a bicycle	75.8	84.6	83.8
Rarely or never wear seatbelt when riding in a car	61.6	15.7	19.6*
Rode with drinking driver during the past 30 days	60.3	30.3	29.6
Drove after drinking during the past 30 days	57.2	8.5	10.3*
Carried weapon ≥ 1 day during the past 30 days	65.7	15.0	13.3
Carried gun ≥ 1 day during the past 30 days	50.8	4.2	4.4
Carried weapon on school property ≥ 1 day during the past 30 days	57.7	5.1	5.7
Felt too unsafe to go to school ≥ 1 day during the past 30 days	42.0	5.5	5.0
Threatened or injured with weapon on school property ≥1 time in the past 12 months	40.6	7.3	5.9
In a physical fight ≥1 time during the past 12 months	67.8	34.6	30.3*
Injured in a physical fight ≥1 time during the past 12 months	47.0	2.9	4.4*
In a physical fight on school property ≥ 1 time in past 12 months	64.4	13.1	12.4
Physically hurt by boyfriend or girlfriend during the past 12 months	53.6	9.1	9.9
Ever forced to have sexual intercourse	65.8	9.1	10.3
Felt sad and hopeless during the past 12 months	56.4	28.2	24.1*
Considered suicide during the past 12 months	74.3	17.0	16.0
Planned suicide during the past 12 months	66.6	13.0	12.9
Had ≥1 suicide attempt during the past 12 months	72.7	8.4	8.5
Had injurious suicide attempt during the past 12 months	52.3	2.1	2.7
Tobacco use behaviors			
Ever used cigarettes	85.7	65.8	63.9
Age first smoked whole cigarette <13 years	70.9	21.4	23.7
Smoked cigarettes ≥1 day during the past 30 days	81.9	27.2	27.5
Smoked ≥ 20 cigarettes per day on the days smoked during the past 30 days	83.5	17.5	17.1
Bought cigarettes in a store or gas station during the past 30 days	69.3	6.4	7.2
Asked to show ID when buying cigarettes during the past 30 days	52.8	6.8	8.2
Smoked cigarettes ≥1 day on school property during the past 30 days	71.4	9.7	9.1
Ever smoked cigarettes regularly	79.8	17.7	19.0
Tried to quit smoking cigarettes during the past 12 months	70.3	18.4	16.7
Used smokeless tobacco during ≥ 1 of the past 30 days	71.1	6.6	6.4
Used smokeless tobacco on school property during ≥ 1 of the past 30 days	60.4	3.9	3.9
Smoked cigars ≥1 day during the past 30 days	59.7	12.2	11.8
No usual brand of cigarettes during the past 30 days	37.3	1.6	1.5
Alcohol and other drug use behaviors			
Ever used alcohol	81.9	76.1	72.5*
Age first drank alcohol <13 years	65.9	28.9	29.9
Drank alcohol ≥1 day during the past 30 days	70.9	41.1	39.9
Had 5 or more drinks in a row ≥1 day during the past 30 days	67.6	23.9	23.7
Drank alcohol on school property ≥1 day during the past 30 days	49.4	3.9	4.1
Ever used marijuana	89.8	42.8	41.7
Age first used marijuana <13 years	70.3	10.5	11.3
Used marijuana during the past 30 days	76.0	22.6	22.1
Used marijuana on school property during the past 30 days	59.1	5.5	5.3
Ever used cocaine	73.4	5.6	6.2
Used cocaine during the past 30 days	48.3	2.2	2.7
Ever used inhalants	67.0	11.3	10.6
Used inhalants during the past 30 days	42.2	2.9	3.5
Ever used heroin	57.4	1.9	3.0*
Ever used methamphetamines	70.7	6.3	6.9
Ever used steroids	45.1	4.0	4.1
Ever injected illegal drugs	53.9	1.4	2.0
Offered, sold, or given illegal drugs on school property during the past 12 months	52.2	23.0	21.9
Sexual behaviors			
Ever had sexual intercourse	90.5	49.5	50.2
Age first had sexual intercourse <13 years	40.4	18.0	14.8*
Had ≥4 lifetime sex partners	57.9	19.1	17.6

(Continued)

Table 2. Continued

Item	Kappas (%)	Time 1 (%)	Time 2 (%)
Had ≥1 sex partner during the past 3 months	72.7	32.9	35.0
Ever been pregnant or gotten someone pregnant	51.9	8.6	8.2
Dietary behaviors			
Perceive self as overweight	58.6	22.7	26.1*
Trying to lose weight	58.2	33.8	37.2*
Exercised to lose or keep from gaining weight during the past 30 days	57.6	58.6	53.9*
Ate less food, calories, or fat to lose or keep from gaining weight during the past 30 days	53.2	43.1	40.4
Fasted to lose or keep from gaining weight during the past 30 days	40.1	18.4	15.3*
Took diet pills, powders, or liquids to lose or keep from gaining weight during the past 30 days	42.1	7.8	7.9
Vomited or took laxatives to lose or keep from gaining weight during the past 30 days	40.3	4.9	5.0
Physical activity behaviors			
Watch ≤2 hours of television on an average school day	46.7	62.4	63.2
Attend physical education class ≥1 day a week	84.8	62.4	56.8*
Exercise >20 minutes during physical education class	41.1	72.3	69.0
Played on ≥1 sports team during the past 12 months	56.2	54.6	53.3
Injured during physical activity ≥1 time during the past 12 months	47.1	40.8	35.2*
Other health-related topics			
Ever been taught about AIDS or HIV in school	23.6	85.0	86.2
Had physical examination when not sick during the past 12 months	50.5	58.9	58.1
Saw dentist during the past 12 months	63.8	66.5	63.4*
Rarely or never use sun screen when in the sun for >1 hour	61.1	66.6	66.7

*Time 1 prevalence significantly different from Time 2 prevalence based on nonoverlapping 95% CIs.
CI = confidence interval.

itative labels for values of kappa suggested by Landis and Koch [13], 47.2% of items had at least "substantial" reliability (kappas ≥61%), and 93.1% had at least "moderate" reliability (kappas ≥41%). Based on nonoverlapping 95% CIs, 22.2% of items had significantly different prevalence estimates at Time 1 vs. Time 2. Ten items, or 13.9%, had both kappas below 61% and significantly different Time-1 and Time-2 prevalence estimates.

Examination of reliability by respondent characteristics revealed no significant differences in mean values of kappa by gender, grade, or race/ethnicity (Table 3). In addition, although mean kappas were somewhat higher for questions that used lifetime as a reference period than those that used the past 30 days and the past 12 months, these differences were not statistically significant.

Examination of reliability by risk behavior category, however, did reveal some significant differences. Specifically, items related to tobacco use demonstrated significantly higher reliability (mean kappa = 68.8%) than items related to unintentional injuries and violence (mean kappa = 59.9%), dietary behaviors (mean kappa = 50.0%), physical activity (mean kappa = 55.2%), and other health-related topics (mean kappa = 49.7%). In addition, items related to alcohol and other drug use (mean kappa =

Table 3. Mean Kappa Statistics and 95% Confidence Intervals by Demographic and Question Characteristics

Characteristic	Mean Kappa (%)	95% CI
Gender		
Male	57.1	51.3, 63.0
Female	64.3	58.1, 70.6
Grade		
9	57.2	49.5, 64.9
10	61.0	53.9, 68.2
11	60.7	52.3, 69.1
12	63.7	53.8, 73.6
Race or ethnicity		
White	62.5	57.3, 67.8
Black	51.4	42.0, 60.8
Hispanic	58.5	41.7, 75.3
Other	59.0	45.7, 72.2
Reference periods		
Past 30 days	58.1	53.5, 62.6
Past 12 months	59.9	56.1, 63.7
Lifetime	66.3	62.2, 70.3
Risk behavior categories		
Unintentional injuries and violence	59.9	55.7, 64.3
Tobacco use	68.8	64.9, 72.7
Alcohol and other drug use	63.4	58.8, 68.0
Sexual behaviors	62.7	59.6, 65.7
Dietary behaviors	50.0	46.5, 53.5
Physical activity	55.2	52.3, 58.1
Other health-related topics	49.7	46.9, 52.5

63.4%) and those related to sexual behavior (mean kappa = 62.7%) demonstrated significantly higher reliability than items related to dietary behaviors, physical activity, and other health-related topics. Finally, items related to unintentional injuries and violence demonstrated significantly higher reliability than those related to dietary behaviors and other health-related topics.

This pattern of results is parallel to that found when examining which risk behavior categories were more likely to have items with significantly different Time-1 and Time-2 prevalence estimates. For example, although none of the 13 items related to tobacco use had significantly different Time-1 and Time-2 prevalence estimates, four of seven dietary behavior items, two of five physical activity items, and six of twenty injury-related items did demonstrate significant differences between Time 1 and Time 2.

Discussion

Nearly all items on the YRBS questionnaire had at least "moderate" reliability and nearly half had "substantial" reliability. Several items, however, had low reliability and significantly different Time-1 vs. Time-2 prevalence estimates. These items need to be examined further to determine whether they should be revised or deleted in future versions of the YRBS.

The overall findings can be compared with those found in the reliability study of the original YRBS questionnaire [12], as well as the recent study by Klein et al. that included a subset of YRBS items [11]. Although the results of the earlier YRBS reliability study and Klein's study were quite similar, the kappa values in the current study tended to be lower than those in the previous studies, with a few exceptions. The results of all three studies were similar, however, with respect to the relationship between demographic variables and reliability. That is, among high school students, values of kappa did not differ by gender, grade, or race/ethnicity [11,12].

One reason that the mean kappa was lower in the present study than in the previous YRBS reliability study is that many of the items that have been added to the YRBS questionnaire since the earlier study showed kappas lower than 61%. Most of those items, however, such as those measuring behaviors on school property, were of low prevalence. Very low and very high prevalences can adversely affect kappa values because it only takes a few respondents changing their responses between Time 1 and Time 2

to have a substantial effect on kappa [18]. For example, the item assessing whether students smoked a usual brand of cigarettes had a kappa of 37.3%, but the prevalences at Time 1 and Time 2 were 1.6% and 1.5%, respectively.

This study showed that items related to tobacco use, alcohol and other drug use, and sexual behavior demonstrated significantly higher reliability than items related to dietary behaviors, physical activity, and other health-related topics. This is not surprising, given that behaviors related to substance use and sexual activity are likely to be more salient to adolescents, and therefore more reliably recalled, than behaviors related to nutrition, physical activity, and other health-related topics such as health care [19]. Notably, the items related to health care tended to be less reliable than most of the items related to substance use and sexual activity, a finding similar to that of Klein et al. [11].

Limitations

As in other test-retest reliability studies [11,12], any inconsistent response in this study was considered to be a response error when calculating kappa. It is possible, however, that an inconsistent response between Time 1 and Time 2 could reflect an actual behavior change. For example, a student could report at Time 1 that he had not smoked cigarettes in the past 30 days, then report at Time 2 that he had smoked in the past 30 days. Such responses would be inconsistent yet accurate if the student did indeed smoke during the 2-week test-retest interval and not before. The values of kappa computed for this study, therefore, must be considered to be conservative estimates.

Although reliability is a necessary characteristic of a valid measure, the demonstration of the reliability of items on the YRBS questionnaire does not ensure the instrument's validity. Although research with adolescent populations has demonstrated the validity of self-reported alcohol and other drug use [3,20], tobacco use [21–25], suicidal ideation [26], sexual behavior [27, 28], dietary behaviors [29, 30], and physical activity [31], much work remains to be done in assessing the validity of self-report measures of all types of health risk behaviors. This is a challenge, given the lack of objective measures, or "gold standards," for many behaviors of interest. Even when objective measures exist, as is the case for tobacco use and drug use, the use of these measures is not without limitations, especially among adolescent populations [32,33]. To address these issues, re-

searchers have used various techniques, such as randomized response [34], bogus pipeline [35], and computer-assisted data collection [36], with mixed results. Future research should examine ways to encourage even more reliable and valid self-reports of health risk behaviors among adolescents.

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