Continuing Education

Objective and Subjective Knowledge and HIV Testing Among College Students

Su-I Hou

ABSTRACT

Little research has been conducted on the knowledge domain specifically related to HIV testing among college students. Students (age 18–24) were recruited from a major university in the southeastern United States to participate in a Web-based survey during spring 2003 (N=440). About 21% of the students reported previous voluntary HIV tests. Reliability of the overall knowledge test demonstrated good internal consistency (alpha=0.71). Students scored higher on items related to HIV/AIDS in general (percentage correct=82.3%) and lower on items related to HIV testing (percentage correct=70.8%). Subjective rating on HIV testing knowledge (mode=low) was also lower than that of HIV/AIDS in general (mode=medium). Although analyses of knowledge and prior testing revealed significant associations, when using both objective and subjective knowledge in predicting prior HIV testing, only subjective HIV testing knowledge revealed a significant coefficient (odds ratio=2.63). Results indicated both objective knowledge scores and subjective knowledge rating were low. Continued efforts on HIV education and prevention are needed among young college students. HIV prevention programs focusing on encouraging HIV testing should pay special attention to participants' subjective knowledge related to HIV testing. The study has implications for using Web-based surveys to assess the effectiveness of Internet-delivered HIV prevention programs.

Increasing the number of HIV-positive persons who know their serostatus is one of the new developmental objectives added and specified in *Healthy People 2010* (U.S. Department of Health and Human Services [DHHS], 2000). Experts estimate that about one-fourth of people infected with HIV do not know they are infected and therefore are not receiving appropriate medical care (Centers for Disease Control and Prevention [CDC], 2003). These people can spread the virus to others without knowing it. Knowledge of HIV status has become an area of emerging importance that health promotion and education professionals cannot overlook.

Evidence indicates that young adults are at risk of contracting HIV due to their related risk behaviors such as unprotected sexual activities and multiple partners. College students constitute part of this group and are at a stage of enjoying new independence and experimenting with risky sexual behaviors. The National College Health Risk Behavior Survey indicated that about 80% of college students (age 18–24 years) reported having sexual intercourse. Approximately one in five had sexual intercourse with more than six people in their lives, whereas the average condom use rate was only 38% in their last sexual intercourse (CDC, 1997).

Although knowledge usually is not sufficient to change behavior, it is, however, almost always a necessity before a change in behavior can occur. Previous studies investigated the relationships between knowledge and HIV testing, yet found somewhat contradictory results from this relationship. Goodman, Chesney, and Tipton (1995) found knowledge was not a predictor of HIV testing among a group of at-risk female adolescents, whereas Anderson, Hardy, Cahill, and Aral (1992) concluded knowledge was significantly related to testing,

Su-I Hou, DrPH, is an assistant professor in the Department of Health Promotion and Behavior at the University of Georgia, 309 Ramsey Center, 300 River Road, Athens, GA 30602.

using a representative sample of the U.S. population. Such differences found in the relation between knowledge and testing behavior could be due to sample differences, sample sizes, methods used, or some combination of these factors.

Knowledge related to HIV/AIDS examined in previous studies focused mostly on AIDS in general, such as symptoms, routes of HIV transmission, and prevention strategies (Anderson et al., 1992; Fitterling, Matens, Scotti, & Allen, 1993; Goodman et al., 1995; Stein & Nyamathi, 2000). Studies investigating knowledge specifically related to HIV testing, such as consent process, confidentiality protection, testing window, incubation period, or availability, have been limited. Knowledge of HIV testing availability (preference) has been studied. Specifically, Valadiserri, Holtgrave, and Brackbill (1993) asked American adults where they would go to be tested for HIV in the Behavior Risk Factor Surveillance Survey using a representative U.S. adult sample obtained through random digital-dialing phone interviews. Their results showed that about 12% did not know where to go for testing. Nevertheless, other aspects of HIV-testing knowledge were not investigated, nor were the relationships between HIV-testing knowledge and testing behavior.

Furthermore, what people perceive they know (subjective knowledge) may be different from what they actually know (objective knowledge). Objective knowledge indices (scores) are usually measured by a set of knowledge test questions, whereas subjective knowledge is often measured by a person's perceived knowledge level on a particular issue. Phillips (1993) first examined the associations of objective and subjective AIDS knowledge, as well as their relationships with the use of HIV testing. She found that objective and subjective knowledge were only moderately correlated, and subjective (but not objective) knowledge was positively associated with voluntary HIV testing. Their study, using National Health Interview Survey data, examined the U.S. general adult population. Research data of similar issues among young adults specifically have not been explored. Knowledge examined in Phillips' study also focused more on HIV/AIDS in general.

Knowledge specifically about the nature of HIV testing could potentially eliminate many concerns most people have about testing, such as anonymity and confidentiality (Phillips & Coates, 1995). It can also help a person know the best time to seek a test (and retest), as well as gain correct understanding of the implications and limitations of testing. Little research has been conducted on the knowledge domain specifically related to HIV testing or among young adults (age 18–24 years) who are more likely to practice risky sexual behaviors, compared with the adult population in general.

This study fills a gap in what is known about HIV-related objective and subjective knowledge among college students. The purposes of this study were to examine (1) the objective and subjective knowledge of HIV testing specifically, as well as HIV/AIDS in general; and (2) the effect of knowledge (objective and subjective) on voluntary HIV-testing behavior among college students.

METHODS

Subjects

College students (age 18–24) were recruited from a major university in the southeastern United States during March–April 2003. Participants of the study were volunteer undergraduate college students, from freshmen to seniors. Although there were some variations within this group, most of them were in the young-adult stage (age 18–24) in which HIV-related risky behaviors are more likely to occur. Graduate students were not included due to the heterogeneous nature of this group, and also because they were considered to be very different from undergraduates.

A Web-based survey was used to assess knowledge and behaviors related to HIV testing. Survey recruiting information, the survey Web site address, and a login password were announced through various channels. To reach a broad base of students, an electronic mailing list of student organizations was used to send out the recruiting message. An electronic mailing list was the most common communication channel at the participating university. The student newspaper was another major channel of communication on campus, because most students read the student newspaper daily. Therefore, the survey recruiting advertisement (1 week long) was also placed in the student newspaper. In addition, project flyers were placed at several major locations around the campus, such as the student recreation center, the student activity center, libraries, dining halls, student residence halls, major classroom buildings, just to name a few. During the recruiting period the project research assistant also distributed handouts around noon during selected days at the student activity center where most students gather for lunch and other activities. Using more than one channel to reach the target population was the recruiting strategy with the intention to help reinforce the message and serve as reminders. A password was used to ensure that respondents who participated in the survey were reached through the various recruitment efforts, thus eliminating the possibility that someone would accidentally encounter the Web site on the Internet and access the survey. A total of 440 students completed the Web survey. This research was conducted with the approval of the Institutional Review Board for the Protection of Human Subjects at the university.

Research purposes and confidentiality issues were briefly explained in the recruiting materials. A complete informed consent form was used as the login screen at the Web site. Each student was required to "click through the screen for consent" and login with the project password before he or she could complete the survey. Students were told that their participation was voluntary and that they could simply withdraw without penalty by closing the Web browser at any time or skip any question they felt uncomfortable answering. Participants were also informed about the limitation to the confidentiality (privacy) that could be guaranteed while communicating through the

Internet due to the Internet technology itself. However, once the completed surveys were received, standard procedures were employed to ensure privacy. No names were asked, and all the identifying information received, such as the IP address of the student's computer, was deleted immediately from the secured database server after the survey was received. As a token of appreciation for their participation, students were directed to a Web page with coupons of local merchants. The coupon page was accessible only after students finished the survey.

Instrument Development

The Web-delivered survey was developed in four major phases. First, existing literature and social/behavioral theories contributed to the development of the initial draft. Second, an expert panel (including three HIV researchers, four health care professionals, and three college students) was asked to assess the suitability of the survey items, especially the content validity of the knowledge questions (e.g., content relevance, representativeness, technical quality) (Messick, 1995). Four questions also thought to be important were added to the original 12 items in the knowledge test. The topics of these 4 questions included the consent procedures of receiving HIV, window period of testing, and risk of infection among women. Three knowledge questions were reworded to increase clarity and reduce potential confusion. Third, the revised survey instrument in paper-and-pencil form was administered to a classroom sample of students (n=223) for pilot testing before it was ready to be transformed into Web-delivered format. Survey length, layout, item clarity, and comprehension level were also assessed during the expert interviews and pilot testing. The survey was then revised and refined based on the feedback and comments from both the experts and college students before being posted on the Web. The final survey instrument was reviewed again by the expert panel. The relevance, representativeness, clarity, and quality of the knowledge questions were all rated high or very high. Finally, the survey was then developed into Web-page format by a Web-development expert. Another small convenience sample of college students (n=25) was asked to provide additional feedback on survey layouts, flows, and user friendliness.

The final Web survey instrument consisted of a total of 84 items, including 5 items of HIV-testing practice, 16 items of knowledge (11 general questions related to HIV/AIDS and 5 specific quesitons related to HIV testing), 12 items of sexual behaviors, 32 items of testing-related beliefs, and 19-items of background information (including two quesitons of subjectively rated knowledge levels). This article specifically examined the relationships between knowledge and HIV-testing behavior.

In addition to validity assessment, internal reliability and item difficulty of the knowledge test were assessed. The internal consistency analysis showed that the knowledge items were reliable (Cronbach alpha=0.71). The corrected item total correlation (CITC) showed that all of the items were sufficiently correlated with each other (CITC>0.20). Although three questions revealed smaller CITC, the values were close to 0.20. After consulting and discussing the issue with the expert panel members, one question ("Teenagers and young adults are at high risk of being infected with HIV.") was removed from the knowledge test analyses. The reason was that definitions of high risk could be subjective, and not all teenagers and young adults are at high risk for HIV infection. The other two questions ("A person can get HIV from oral sex" and "A person can get HIV even if he/she has only one unprotected sexual encounter with another HIV-infected person") were considered appropriate and important to the HIV knowledge test, and thus, were kept in the analysis. The overall internal consistency was not compromised when we kept these two questions. Among the remaining 15 knowledge questions, 10 had an item mean of 0.70 or higher, meaning that more than 70% of the students answered these questions correctly (i.e., easy items). The other five questions showed item means in the range of 0.30 and 0.70 (i.e., moderately difficult items). Among those five moderately difficult items, three were specifically related to HIV testing (Table 1).

The two subjective knowledge questions were developed based on the one subjective knowledge question used in Phillips' study (Phillips, 1993). The two questions were "How would you rate your knowledge about HIV/AIDS in general?" and "How would you rate your knowledge specifically related to HIV testing?"

Data Analysis

Data on demographics were described under Subjects. Age, gender, and sexual orientation were included in the multiple logistic regression models to further assess the effect of knowledge on HIV-testing behavior.

For the objective knowledge test (15 items), internal consistency reliability was calculated. A scale with Cronbach alpha above 0.70 was considered good reliability. Items with discrimination (CITC) less than 0.20 were reevaluated for their clarity and content. Knowledge questions were scored one (1) if answered correctly and were scored zero (0) when answered incorrectly or when the response was "do not know." Item means that fell in the range of 0.30–0.70 were considered moderately difficult items (Nunnally & Bernstein, 1994). Based on the analysis of range of content and balance of content coverage by the expert panel (Messick, 1989), the knowledge questions were reviewed for representativeness and were grouped into two categories, general questions related to HIV/AIDS (10 items) and specific questions related to HIV-testing (5 items). These two tests of knowledge questions were created by adding the items together. Descriptive statistics (number of items, scale mean, range, percentage correct, etc.) were reported (Table 2).

Subjective knowledge was rated by participants' perceptions on a 5-point Likert-type scale from "*very high*" (coded as "5") to "*very low*" (coded as "1"). The Spearman-rank correlation coefficient was used to assess the correlations between objective and subjective knowledge. Mann-Whitney U

Table 1. Objective Knowledge Test Among College Students

Knowledge items (correct answer: T=true/F=false)	CITC[A]	True (%)	False(%)	Not Sure (%)
Teenagers and young adults are at high risk of being infected with HIV. (T)	.1851	89.6	3.7	6.7
HIV/AIDS can be transmitted through mosquito bites. (F)	.3290	7.4	79.5	13.1
HIV/AIDS can be transmitted if uninfected person donates his/her blood. (F)	.2367	26.2	66.1	7.7
A person can get HIV from oral sex. (T)	.1846	76.3	10.9	12.8
Taking an HIV test 1 week after having sex can tell a person if he/she has HIV.[B] (F)	.4018	7.7	64.5	27.8
A person can get HIV even if he/she has only one unprotected sexual encounter with an HIV-infected person. (T)	.1971	95.8	2.5	1.7
In general, it takes 3–6 months for a person with HIV to develop AIDS. (F)	.2670	21.7	45.7	32.6
HIV testing cannot be done unless you request or agree to have it done.[B] (T)	.2009	85.9	3.5	10.6
A person would know if he/she had been infected with HIV. (F)	.4135	3.2	92.3	4.4
A person with HIV can look and feel healthy. (T)	.2475	96.3	2.0	1.7
A pregnant woman with HIV can pass the virus to her baby (fetus). (T)	.2998	94.3	1.7	4.0
It is harder for women to get HIV from men than for men to get HIV from women. (F)	.3259	6.2	76.3	17.5
HIV testing is usually anonymous and/or confidential.[B] (T)	.3097	93.3	1.0	5.7
Douching after sex can keep a woman from getting HIV. (F)	.4199	1.0	91.9	7.2
Any time blood is drawn, it is tested for HIV.[B] (F)	.2569	25.4	52.3	22.2
It takes a couple of weeks or months from infection with HIV for detection by testing.[B] (T)	.4557	57.9	8.2	33.9

Notes: Cronbach alpha (15 items) =.71. *N*=440. Knowledge scale items were scored one (1) if answered correctly and were scored zero (0) when answered incorrectly or when the response was "do not know." Percentage correct of each item was highlighted in **bold.**

[A]Corrected item total correlation

[B]Knowledge items measuring HIV testing specifically.

Table 2. Descriptive Statistics of Objective Knowledge Scales and Subjective Knowledge Ratings

	Number of Items	Scale Mean (SD)	Range	% Correct
Objective Knowledge				
Knowledge (All)	15	11.70 (2.44)	0-15	78.00%
Knowledge (HIV/AIDS)	10	8.15 (1.60)	0-10	81.53%
Knowledge (HIV testing)	5	3.54 (1.25)	0-5	70.90%
Subjective Knowledge		Item Mean (SD)	Range	Mode
Perceived HIV/AIDS knowledge[A]	1	3.27 (.78)	1-5	3 (medium)
Perceived HIV-testing knowledge[A]	1	2.58 (.90)	1-5	2 (low)

Notes: *N*=440.

[A]Perceived knowledge (subjective knowledge) was rated on a 5-point Likert-type scale from 1 (*very low*) to 5 (*very high*).

tests were used to assess the univariate relationships between knowledge and voluntary HIV-testing behavior. Multiple logistic regression analysis was used to assess how well the four knowledge assessments (objective and subjective, HIV/AIDS in general and HIV testing) distinguished between students who reported prior HIV testing and those who had never been tested.

RESULTS

Demographics of the Sample

Among the participating students (*n*=440), 73.4% were women, 83.5% were White, 89.8% were not married, and 90.2% reported heterosexual orientation. Mean age was 20.1 (SD=2.26). Only 21.1% (*n*=93) of the students reported they had previously had a voluntary HIV test. Compared with the most recent student profile at this university (76.2% age 18–24) (Office of Institutional Research, 2003), the current study sample showed comparable student age but a higher proportion of women students (Hou & Wisenbaker, in press).

Objective Knowledge Test

The mean score of the 15 knowledge

Table 3. Correlation of Objective with Subjective Knowledge

	Knowledge (All)	Knowledge (HIV/AIDS)	Knowledge (HIV Testing)	Perceived Knowledge (HIV/AIDS)
Objective Knowledge				
Knowledge (All)	-			
Knowledge (HIV/AIDS)	.890**	-		
Knowledge (HIV Testing)	.811**	.456**	-	
Subjective Knowledge				
Perceived HIV/AIDS knowledge	.383**	.363**	.282**	-
Perceived HIV-testing knowledge	.421**	.306**	.354**	.592**

Note: *N*=440.
**Correlation is significant at the .01 level (2-tailed).

Table 4. Objective and Subjective Knowledge and HIV Testing Among College Students

	Ever Been Tested	Mean Rank[A]	*P*-Value
Objective knowledge (all)	No	187.32	.000**
	Yes	250.83	
Objective knowledge (HIV/AIDS)	No	192.20	.001**
	Yes	239.23	
Objective knowledge (HIV testing)	No	189.69	.000**
	Yes	244.33	
Subjective knowledge (HIV/AIDS)	No	189.61	.000**
	Yes	244.64	
Subjective knowledge (HIV testing)	No	181.55	.000**
	Yes	275.53	

[A]Mann-Whitney U test was used to examine the significance level.
**Significance level <.01

items was 11.70. That is, the percentage correct of the knowledge test would be 78% (11.70/15) if the total score was 100 (Table 2). Results also showed that students in the study scored higher on questions related to HIV/AIDS in general and lower on questions related to HIV testing specifically. The test mean for the general knowledge questions related to HIV/AIDS (10 items) was 8.15, whereas the test mean was 3.54 for specific questions related to HIV testing (5 items). That is, on average, the percentage correct was 81.5% (8.15/10) for HIV/AIDS knowledge in general and 70.9% (3.54/5) for HIV testing knowledge. Analysis showed HIV-testing knowledge was significantly lower than HIV/AIDS knowledge in general ($t_{(401)}$= –8.926; p<.001).

Subjective Knowledge Rating

The subjective knowledge was rated on a 5-point Likert-type scale, which also revealed lower rating for perceived HIV testing knowledge (mean=2.58; mode=2 [low]) than perceived HIV/AIDS knowledge in general (mean=3.27; mode=3 [medium]). Similarly, the perceived HIV-testing knowledge was significantly lower than the perceived HIV/AIDS knowledge in general ($t_{(401)}$= –17.906; p<.001) (data not shown).

Scores of the objective knowledge test and ratings of the two subjectively perceived knowledge levels were correlated with each other significantly, with all p-values less than .01 (Table 3). Although these correlations were statistically significant, the variances (R^2) in general were relatively small, suggesting a minimum effect size.

Relationships Between Knowledge and Voluntary HIV Testing

The univariate analyses of knowledge and prior voluntary HIV testing revealed significant associations. Students who scored higher on objective knowledge were more likely to have been tested for HIV (p<.001). The same relationship existed between rated subjective knowledge and previous HIV-testing behavior (Table 4).

When using both objective and subjective knowledge in predicting prior voluntary HIV testing behavior, the multiple logistic model indicated the model was statistically reliable in distinguishing between students who reported prior HIV testing with students who have never been tested ($X^2(4)$=55.10, p<.001). The model correctly classified 80.9% of the students. However, Wald statistics indicated that only the subjective knowledge of HIV testing (OR=2.63; 95% confidence interval [CI]= [1.78, 3.86]) revealed statistically significant coefficients (p<.001). After demographic factors (age, gender, and sexual orientation) were added into the model, findings revealed that the full model significantly predicted prior voluntary testing behavior better than the constant only model ($X^2(7)$=78.45, p<.001). The correct classification percentage was 81.4%. Similarly, subjective knowledge of HIV testing was the only knowledge that was significant in predicting prior voluntary testing (OR=2.63). In addition, age revealed significant coefficients (OR=1.30; 95% CI= [1.14, 1.50]; p<.001). Neither gender nor sexual orientation revealed significant prediction in the full model (Table 5).

DISCUSSION

About 21% of the students in the current study reported that they had a prior voluntary HIV test. In the earlier pilot study, using a selected classroom sample of college students, data showed a lower testing rate (12%) (unpublished observations). The differences in the pilot and the current sample, as well as the different modes of data collection, could all contribute to the different reporting rates. It was also possible that those who had a prior HIV test might be more likely to respond to the survey, indicating the actual rate among college students could be even lower. Other factors contributing to previous testing and current high-risk behaviors could be age (Bernard & Prince, 1998), higher sexual activities, or other behavioral risks (Anderson et al., 1992; Goodman & Berecochea, 1994). Bernard and Prince (1998) examined HIV-testing behavior among college students (in a Midwestern college). Their findings suggested that younger people (particularly those under age 25) reported a significantly lower HIV testing rate than those in age groups over 25. Although their finding showed a higher HIV-testing rate (37%) among college students, a higher proportion of the students in their sample was older and married. Furthermore, the difference in geographic regions could also lead to differences in findings between their study and the current one. Nevertheless, the overall HIV testing rate among college students was low. The true HIV testing prevalence among college students, particularly by age and geographic regions, needs to be further examined.

The score of the objective knowledge test revealed good reliability (15 items). Test items consisted of an appropriate mix of easy items (66.66%) and moderately difficult items (33.33%). Knowledge items that showed less than 70% of students answered correctly (item mean <0.70) included knowledge of HIV transmission in the case of blood donation, latent period of AIDS, window period of HIV testing, and the consent process before HIV testing. College students demonstrated basic understanding of general information on HIV/AIDS. However, the survey showed college students still need to be educated about other important concepts related to HIV/AIDS testing. Misconceptions could result in students underestimating their risk, ignoring the importance of testing, or having false assurance from some of the negative test results. More research should further investigate knowledge related to HIV testing to develop effective programs to encourage early testing among young people.

The univariate analyses revealed that objective and subjective knowledge, HIV/AIDS in general, or HIV testing specifically were all significantly associated with prior HIV testing behavior. However, when considering objective and subjective knowledge simultaneously, the multiple logistic regression models showed that only the subjectively rated knowledge on HIV testing showed significant prediction to prior voluntary HIV testing behavior. Phillips (1993) also concluded that subjective (but not objective) knowledge was significantly associated with voluntary testing, although knowledge domain was not further separated into HIV/AIDS in general and HIV testing in her study.

The combined use of various strategies was shown to be successful in recruiting participants. Such strategies included both broad-based communication channels such as the university-based student electronic mail listing and student newspapers, as well as locally (project flyers) and more personally delivered channels (mini-handouts). Although it was impossible to know how many students were reached

Table 5. Coefficients for Multiple Logistic Regression Model Variables (Full Model)

	B	SE	Wald	df	*p*-Value	Odds Ratio (OR)	95% Confidence Interval for OR Lower	Upper
Objective knowledge (HIV/AIDS)	1.023	1.241	.680	1	.409	2.783	.245	31.666
Objective knowledge (HIV testing)	.955	.733	1.700	1	.192	2.600	.618	10.932
Subjective knowledge (HIV/AIDS)	-.039	.231	.028	1	.867	.962	.612	1.513
Subjective knowledge (HIV testing)	.968	.210	21.257	1	.000**	2.633	1.745	3.975
Age	.265	.070	14.299	1	.000**	1.304	1.136	1.496
Gender[A]	-.026	.324	.007	1	.935	.974	.516	1.838
Sexual orientation[B]	-.682	.418	2.657	1	.103	.506	.223	1.148

Notes: Voluntary HIV testing=objective knowledge (HIV/AIDS)+objective knowledge (HIV testing)+subjective knowledge (HIV/AIDS)+subjective knowledge (HIV testing)+age+gender+sexual orientation. [$X^2_{(7)}$ =78.45, p<.001]. Correct classification: 81.4%.

[A]Reference category: male.

[B]Reference category: heterosexual.

during recruitment, the current study received responses from more than 400 participating students during a relatively short period of time (4–6 weeks), with a survey completion rate ranging between 88 and 96% (Hou & Wisenbaker, in press). The current study was among the first to use a Web-delivered mode to assess HIV-related knowledge and testing behavior. The majority of the participating students commented that the Web-delivered survey was easy to complete, and that survey items were thorough, thought-provoking, and clear. Future research can add a question on how (or where) students learn about the survey, and thus, the most successful recruitment strategies can be further assessed.

Several potential limitations of this study should be noted. Although we used several channels to reach a broad-based student population, participants in the study were students who volunteered, took the action to visit the survey Web site, and completed the survey. Therefore, generalization of the study findings should consider the different demographics or other background factors of volunteers versus a random sample. Test-retest reliability was not assessed in the current study. Although test-retest can help us assess temporal stability, it is not practical, because repeated measurements are likely to change the participants (American Educational Research Association [AERA], American Psychological Association, & National Council on Measurement in Education, 1985). For example, participants adapt to the test format or may look for test answers after the first test and thus tend to score higher in later tests (AERA et al., 1985). Another major concern is what has been termed the memory effect (Heffner, 2004). This is especially true when the two administrations are close together in time, resulting in examinees answering the way they did on the first test rather than reading through the questions carefully. This can create an artificially high reliability coefficient as subjects respond from their memory rather than to the test itself.

This study included five items on HIV testing specifically. More items on HIV testing could be further developed in the future, for example, the meaning of both positive and negative test results, benefits of testing, the availability of needle-free testing and rapid results, or consequences of late detection, and so forth. In addition, although subjective knowledge was measured separately for HIV/AIDS in general and HIV testing, only one item was used to assess each knowledge domain. Phillips (1993) suggested that, in addition to objective knowledge, asking even one question on subjective knowledge can provide information about who is likely to seek testing. However, additional items measuring the subjective knowledge might strengthen comparisons. More studies are needed to develop additional HIV testing-related knowledge items and to continue examining HIV testing-related knowledge among at-risk populations to better develop effective programs to encourage testing.

In summary, this study found college students received low scores on the HIV knowledge test. Most of these young college students self-rated their knowledge level as medium (HIV/AIDS in general) or low (HIV testing). When considering the various knowledge measures simultaneously, only the subjective knowledge related to HIV testing showed significant correlation with voluntary HIV testing. The score of the knowledge test scale obtained through the Web-based survey among the participating students was reliable. Findings of this study have implications for using the Internet as a data collection method to assess health-related knowledge and behaviors, such as HIV testing. Future studies can consider integrating the Web-assessment tool to examine the effectiveness and feasibility of Web-delivered HIV intervention programs that address HIV testing among young adults. Continued HIV educational efforts are needed to improve the less than satisfactory knowledge levels among populations who practice frequent HIV risk behaviors. HIV prevention program efforts focusing on encouraging HIV testing should pay special attention to participants' subjective knowledge related to HIV testing.

REFERENCES

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1985). *Standards for educational and psychological testing.* Washington, DC: Authors.

Anderson J. E., Hardy A. M., Cahill K., & Aral S. (1992). HIV antibody testing and posttest counseling in the United States: Data from the 1989 National Health Interview Survey. *American Journal of Public Health*, *82*, 1533–1535.

Bernard A. L., & Prince A. (1998). HIV testing practices and attitudes of college students. *American Journal of Health Studies*, *14*, 84–94.

Centers for Disease Control and Prevention. (1997). Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey—United States, 1995. \t "_blank" *Morbidity and Mortality Weekly Report*,.htm" \t "_blank" *46* (SS-6), 1–54.

Centers for Disease Control and Prevention. (2003). *New CDC initiative would increase HIV testing and enhance prevention for persons living with HIV.* Retrieved June 4, 2003, from http:///od/oc/media/pressrel/r030417.htm" www.cdc.gov/od/oc/media/pressrel/r030417.htm

Fitterling J. A., Matens P. B., Scotti J. R., & Allen J. S. (1993). AIDS risk behaviors and knowledge among heterosexual alcoholics and non-injecting drug users. *Addiction*, *88*, 1257–1265.

Goodman E. & Berecochea J. E. (1994). Predictors of HIV testing among runaway and homeless adolescents. *Journal of Adolescent Health*, *15*, 566–572.

Goodman E., Chesney M. A., & Tipton A. C. (1995). Relationship of optimism, knowledge, attitudes, and beliefs to use of HIV antibody testing by at-risk female adolescents. *Psychosomatic Medicine*, *75*, 541–546.

Heffner C. L. (2004). *Research methods AllPsych Online*. Retrieved July 21, 2004, from validityreliability.html" http://allpsych.com/researchmethods/validityreliability.html

Hou, S., & Wisenbaker, J. (in press). Using a Web survey to assess correlates of intention towards HIV testing among never-been-tested but sexually experienced college students. *AIDS Care.*

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed.). New York: Macmillan.

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into scoring meaning. *American Psychologist, 9*, 741–749.

Nunnally J. C., & Bernstein I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.

Office of Institutional Research, the University of Georgia. (2003). Student profile—spring semester 2003. Retrieved June 25, 2003, from http://irhst40.irp.uga.edu/html/sp2003/irpk/student/Sirs/profile/profile.html

Phillips, K. A. (1993). Subjective knowledge of AIDS and use of HIV testing. *American Journal of Public Health*, *83*, 1460–1462.

Phillips, K. A., & Coates, T. J. (1995). Who plans to be tested for HIV or would get tested if no one could find out the results? *American Journal of Preventive Medicine*, *11*, 156–162.

Stein, J. A., & Nyamathi, A. (2000). Gender differences in behavioral and psychosocial predictors of HIV testing and return for test results in a high-risk population. *AIDS Care*, *12*, 343–356.

U.S. Department of Health and Human Services. (2000). *Healthy People 2010* (2nd ed.). With understanding and improving health and objectives for improving health. Washington, DC: U.S. Government Printing Office.

Valdiserri, R. O., Holtgrave, D. R., & Brackbill, R. M. (1993). American adults' knowledge of HIV testing availability. *American Journal of Public Health*, *83*, 525–528.