Research Articles

Alternative Modes of Measuring Self-reports on HIV-related Behaviors Among College Students: Web-delivered Mode Versus Paper-Pencil Mode

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ABSTRACT

HIV-related behaviors, self-reported using Web-delivered or paper-pencil modes, were collected from two convenience samples of college students at a major university in the southeastern U.S. To enhance the equivalence of the comparisons, a subset pool of participants from each group, proportionally matched on key demographic variables including age, gender, and race, was randomly selected to be included in the analysis. Multiple-regression analyses showed similar self-reporting patterns on HIV testing-related behaviors and intention, as well as various sexual behaviors (oral, vaginal, and anal), initial age of sexual activity, number of partners, alcohol and condom use (Type I error adjusted), with the exception that prevalence of self-reported behaviors on alcohol use before and condom use during anal sex were higher from data collected via Web-delivered mode. Age and peer norms were consistently shown as significant positive predictors for the various sexual activities. The implication of using the Internet to collect HIV-related behavioral data are discussed.

INTRODUCTION

Sexual contacts are by far the major route of HIV transmission among emerging adults.[1] About 50% of new HIV infections are among people under 25 years old, and the majority of them are infected sexually (rather than through intravenous drug use or other possible means of infection). College students are part of this age group, which actively practices various sexual behaviors. The National College Health Risk Behavior Survey[2] indicated that the majority of college students reported having engaged in sexual intercourse (80%). About one-fourth (26%) had sex with more than six people in their lives, yet only 38% used a condom during their last sexual intercourse.

Despite some criticism and concerns regarding self-reported sexual behaviors, researchers and practitioners continue to rely on self-report methods to assess HIV-related risky behaviors. One major reason for doing so relates to the ethical and practical considerations that limit the use of more direct assessment methods.

Few studies have examined whether alternative modes of data collection are compatible, especially when measuring sensitive behaviors. Williams and colleagues (2000) were one of the few who examined this topic.[3] They compared the consistencies of self-reported drug use and sexual behaviors using computer-assisted versus face-to-face interview practices. Study participants came from a sample of drug users and were interviewed in non-clinical, community-based storefronts. Their study results showed that data obtained from the voice-enhanced computer interview with touch-screen responses are compatible to data obtained using interviewer administered face-to-face interviews.[3] A study conducted by Turner and colleagues found that for sensitive data such as male-male sexual behaviors and drug use, self-reported prevalence among adolescent males was higher using the audio-computer assisted mode compared with paper-pencil mode in data collection.[4] Another earlier study, conducted by McEwan and colleagues, compared a mailed survey to face-to-face interviews on HIV-related behaviors. Although the two assessments were administered to different samples, the researchers concluded that, if in-depth responses are not needed, self-administered surveys are better for obtaining information on risky behaviors such as sexual behavior.[5] Currently, there is little consensus among researchers regarding

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which administration mode yields the most reliable and valid data on sensitive behaviors. Weinhardt and colleagues reviewed empirical literature since 1990 regarding reliability and validity of self-report measures of HIV-related sexual behavior.[6] They urged that additional research focusing on modes of administration with diverse populations is much needed.

Catania and colleagues commented that people often prefer to hide sexual or related behaviors that put them at risk of HIV infection, failing to report or underreporting such behaviors.[7] Recent evidence suggests that it is now feasible to collect health-risk behavior data from the Internet among populations, such as college students, known to be regular users of e-mail and the Internet.[8–10] With the increasing use of the Internet by the whole population, especially the younger generation, it is believed that young people would be more comfortable, and thus, more likely to report such behaviors via the Internet mode. Such a data collection mode can allow participants to respond to a health-related survey at their own pace and in a preferred environment such as their home. This mode also provides a uniform and consistent method of data collection without wasting paper. One previous study reports that study participants preferred answering sensitive behavior questions using a computer rather than providing information to human beings.[11]

The purpose of this study was to assess the compatibility of using alternative modes (i.e., Web-delivered vs. paper-pencil) to assess self-reported HIV-related behaviors among college students. In particular, this study examined HIV testing-related behaviors and intentions. In addition, the various sexual behaviors commonly measured by HIV behavioral studies were examined in detail, such as ever engaging in sexual activities (oral, vaginal, and anal), initial age of engaging in these sexual activities, partner numbers, alcohol use before sex, and condom use. If the Web-delivered survey could provide compatible information as that collected by paper-pencil mode, there are definite advantages to using the Inter-

net for collecting sensitive health-related information. Factors that warrant consideration when examining HIV-related behaviors are also discussed.

METHODS

Participants and Procedure

Self-reported HIV-related behaviors, through either Web-delivered or paper-pencil modes, were collected from two convenience samples of college students from a major university in the southeastern US in 2003. For the paper-pencil survey, an anonymous, self-administered survey was given to a sample of students from six different classes (N=223). The participating classes included a large introductory health class, as well as physical education, sport science, research methods, community health, and human sexuality classes. Although all of the classes were health-related, some introductory-level courses are commonly taken by diverse undergraduate students. The purpose of the research was explained, and students were told that completing the survey was totally voluntary and would not affect their grades in the class. Students who wished not to participate were instructed to return the blank survey to the researcher. Almost all students in the participating classes completed the paper-pencil survey.

To recruit students for the Web-delivered survey, study information with survey Web site address and login password was disseminated through flyers, colored mini-handouts, student newspapers, and e-mail listservs of student organizations. Students were instructed that they would be directed to a Web page with coupons for local merchants after completing the survey. A total of 440 students participated in the Web-delivered survey. Informed consent was used as the login screen on the survey Web site. After login, students were asked if they had taken the survey before. Less than 1% of the students indicated they took the survey more than once and these cases were removed from analyses. Although the computer setting could allow students to answer personal questions more candidly, the limi-

tation of the confidentiality on the Internet was explained. The survey, administered via either mode, took about 12–15 minutes to complete. This research was conducted with the approval of the Institutional Review Board for the Protection of Human Subjects at the University (No. H2003-10245).

Measures

Development of the survey instrument was conducted in three phases: (1) reviewing previous studies, existing national risk behavior surveys designed for college students or late adolescents, existing social and behavioral theories, and drafting a preliminary survey; (2) interviewing experts and practitioners to obtain feedback on the survey draft and to explore other potential factors related to HIV testing; and (3) applying the survey to a small group of students to test comprehension and clarity of the items. The survey was then revised and refined several times based on the feedback and comments from the experts and practitioners (n=9) and college students (n=6) to enhance validity and comprehension before being administered to students.

The final survey consisted of the following five major sections: (1) HIV testing behaviors, (2) beliefs related to HIV testing, (3) sexual behaviors, (4) knowledge related to HIV and testing, and (5) demographic and background information, including peer norms of sexual activities and self-rated HIV/AIDS related knowledge. The current study focused on examining variables in sections (1), (3), and (5). Results on variables in other sections are reported elsewhere.[12,13]

Items on HIV testing-related behaviors were adapted from previous research.[14] The majority of the sexual behavior questions were adapted from the National College Health Risk Behavior Survey (NCHRBS) and the Youth Risk Behavior Surveillance Survey (YRBSS) developed by U.S. Centers for Disease Control and Prevention (see Table 2).

Peer norms have been considered as important predictors of sexual behaviors among late adolescents such as college students.[15] Given the importance of peer

influence during the developmental period of late adolescence, Brown, DiClemente, and Reynolds suggest including peer norms in predicting sexual behaviors in late adolescents and emerging adults.[16] Existing studies have demonstrated that peer norms have significant association with various HIV-related risk behaviors, such as sexual activities[17,18]; condom use[15,19]; or drug use.[20] In the current study, perceived peer norms of sexual activities (perceptions of whether close friends are engaging in sexual activities) were measured as part of the background information. Students were asked to estimate how many of their close friends have engaged in the three types of sexual activities (oral, vaginal, or anal). Response categories ranged among "none," "few," "some," "most," or "all" (coded from 1 to 5).

Two separate questions were asked to assess "subjective knowledge" (self-rated knowledge): (1) "How would you rate your knowledge about HIV/AIDS in general?" and (2) "How would you rate your knowledge specifically related to HIV testing?"[13] Empirical evidence shows that self-rated subjective knowledge, instead of objective knowledge measured by knowledge test, correlate significantly with HIV-risky behaviors and, therefore, were included in the regression analyses.[21] Responses were rated on a 5-point scale from "very low" (coded as "1") to "very high" (coded as "5").

Data Analysis

The primary hypothesis was to test whether reporting patterns on HIV risk behaviors were compatible among college students, using different modes of data collection. To enhance the equivalence of the two samples for HIV risk behavior comparisons, a subset pool of the participants, proportionally matched on key demographic variables, including age, gender, and race, was randomly selected to be included in the analyses. Because the vast majority of the students in the paper-pencil survey were self-identified as heterosexually oriented (98%), the current analyses included heterosexual students only. Although such an approach might

limit some generalizability, it was necessary to ensure that the reported discrepancies on HIV-related behaviors, if any, were not attributed to key demographic variables or sexual orientation identifications among students. Furthermore, concentrating the focus also helps reduce the complexity of comparisons made or interpretations required. Bivariate analyses were conducted to examine demographic and background variables of the two samples. Independent t tests were used for continuous variables; chi-square tests were used for categorical variables, and Mann-Whitney U tests were used for ordinal variables in the comparisons between two groups, with alpha level .05. To assure that differences in HIV risk behaviors and reporting modes were not confounded, demographic and significant background variables were incorporated in the multiple-regression models to adjust additional variances. The issue of potential type I errors resulting from multiple comparisons on the various HIV-risky behaviors (i.e., finding significant relationships by chance) were also taken into consideration. The Bonferroni correction method[22] was used to adjust alpha level to .0025 in the multiple regression analyses.

RESULTS

Demographics and Background Variables of the Two Samples

The total number of heterosexual students participating in the study included 215 from the paper-pencil survey and 358 students from the Web survey. Preliminary comparison of the two samples showed that the Web sample consisted of older (21.2 vs. 20.7 years), more female (75% vs. 61%), and more minority students (16% vs. 8%). Because there was a larger sample from the Web survey, a subset of the Web sample was randomly selected and proportionally matched with the paper-pencil sample on key demographic factors including age, gender, and race. After the post group-matching, the current analyses included a total of 209 heterosexual students from the Web-delivered survey and 214 students from the paper-pencil survey (Table 1).

Bivariate Comparisons of HIV-related Behaviors via Different Reporting Modes

The bivariate analysis of the various HIV-related behaviors reported from Web-delivered versus paper-pencil modes were examined among the post-matched samples. Results showed that data collected via a Web-delivered mode showed students were significantly more likely to report having been tested for HIV or diagnosed with STIs, having ever engaged in anal sex, having had more partners for anal sex, and used alcohol before, or condoms during, anal sex. All other behaviors revealed similar reporting patterns regardless of data collection via either mode (Table 2).

Multiple Regression Analyses on HIV-related Behaviors via Reporting Mode

After taking into consideration the additional variances on demographics and related background factors, multiple regression analyses showed very similar self-reporting patterns on HIV testing-related behaviors and the various sexual behaviors via either data collection modes. With the exception that alcohol use before, and condom use during, anal sex were still more likely to be reported from data collected via a Web-delivered mode, HIV-related behavior patterns were found to be similar via either mode of data collection. These included whether students engaged in any type of sexual activities (oral, vaginal, and anal), initial ages of engaging in such activities, number of partners for sex of any type, and alcohol use before, and condom use during, oral or vaginal sex (Type I error adjusted). Age showed significant coefficients for ever being tested for HIV or diagnosed with STIs, ever asking partner's HIV status, age of first anal sex, and number of partners for oral and vaginal sex. White students were less likely to report use of alcohol before oral or vaginal sex than students self-identified with other races. Peer norms showed significant coefficients on ever engaging in sex of any type, number of partners, and alcohol use before sex of any type (Table 3).

DISCUSSION

Results from the current study indicate

Table 1. Demographic Characteristics of Students Participating in the HIV-related Web Versus Paper-Pencil Survey (Post Group-matched Samples)

Variables		Web Sample N[a]	mean (%)	Paper-Pencil Sample N[a]	mean (%)	p-value[b]
Age (mean)		207	20.96	207	21.17	.214
Gender	Male	79	(37.8%)	84	(39.1%)	.329
	Female	130	(62.2%)	131	(60.9%)	
Race	White	189	(90.4%)	197	(92.1%)	.554
	Others	20	(9.6%)	17	(7.9%)	
Marital	Single	202	(97.0%)	204	(95.3%)	.329
	Married	7	(3.0%)	10	(4.7%)	
Peer—oral sex[c] (mean rank)		209	197.61	210	222.33	.024*
Peer—vaginal sex[c] (mean rank)		209	197.33	202	214.97	.107
Peer—anal sex[c] (mean rank)		208	205.36	195	198.42	.514
Perceived risk of HIV[d] (mean rank)		208	209.17	214	213.77	.677
Perceived HIV/AIDS knowledge[e] (mean rank)		208	206.82	214	216.05	.392
Perceived HIV testing knowledge[e] (mean rank)		208	209.50	214	213.45	.723

Notes:

[a] Students who did not respond to the selected variables were not included. Therefore, the total of students presented in each variable varied accordingly.

[b] Independent t test was used for continuous variable (age), chi-square test was used for categorical variables, and Mann-Whitney U test was used for ordinal variables in the comparisons between two groups.

[c] "Peer—oral, vaginal, or anal sex": Students were asked three separate questions for each sexual activity, "How many of your close friends would you estimate have engaged in sexual activities of any kind (oral sex, vaginal or anal intercourse)?" Response categories were: none, few, some, most, and all; measured for each individual behavior.

[d] Perceived risk of HIV—Students were asked "Please rate your perceived risk of getting HIV during your college life compared with other students of your age." Response categories were: much lower, lower, about the same, higher, and much higher.

[e] Perceived knowledge related to HIV/AIDS in general and specifically related to HIV testing. Two separate questions were asked ("How would you rate your knowledge about HIV/AIDS in general?" and "How would you rate your knowledge specifically related to HIV testing?"), with response categories ranged on a five-point scale; from "very low" to "very high."

* $p<.05$

that self-reporting patterns on the various HIV-related behaviors are compatible with data collected either via paper-pencil or Web-delivered modes. Most of the significant differences found in the bivariate analyses become non-significant in the multiple regression analyses, after adjusting for type I error and additional variances on demographics and peer norms between the two groups of students, with the exception that alcohol use before, and condom use during, anal sex were still more likely to be reported from data collected via a Web-delivered mode. Exploratory comparisons on alternative modes of self-reporting behaviors, with all heterosexual students included in the analyses instead of the post-matching samples, also showed similar results.

Although one must rely on the accuracy of self-reports to measure sensitive behaviors, the current approach provided reasonable evidence that supported the validity of these self-reported behaviors collected via Web or paper-pencil modes. These included: (1) behavioral items were adapted from existing national risk behavior survey designed for college students or late adolescents; (2) data showed higher prevalence of engaging in oral sex followed by vaginal or anal sex; younger age for first oral sex followed by vaginal or anal sex; and more partners for oral sex than vaginal or anal sex. The findings were consistent across data collected from both groups. These data demonstrated some internal consistencies of the behaviors reported; and (3) prevalence of the sexual behaviors was comparable with the National College Health Risk Behavior Survey data, providing additional support for the validity of these self-report measures. All of the evidence provided plausible information that data collected via these behavioral items had reasonable possibility to be valid. Furthermore, the current study used several recommendations from Weinhardt and colleagues' study to ensure validity when measuring sensitive behaviors. For example, the survey was pilot tested in focus groups to ensure comprehension and clarity before it was used

in the study. In addition, questions were asked in a direct fashion, and sequenced from the least to most sensitive (or threatening) questions (i.e., questions about oral and vaginal sex preceded questions regarding anal sex).

One limitation of the current study is the use of a convenience sample. Although using random sampling techniques could potentially increase the generalizability of the results, one could argue that participants would still be self-selected as indicated by their willingness to consent to participate. However, future studies that use random assignment to different modes of data collection would help validate the findings of current research. Another limitation was that this study used two different samples. This potential difference could be due to sampling differences rather than differences in reporting mode.[23] To take this possibility into consideration, as described earlier, the current study used a subset pool of participants that were proportionally matched on key demographic variables and randomly selected in the current analysis. The multiple regression analysis also adjusted additional variances that might result from key demographic or related background factors between the two samples when comparing the various self-reported risky behaviors. The creation of two somewhat equivalent groups which were recruited from the same university, on the other hand, presents a unique way of making comparisons and addressing this limitation.

Translation to Health Education Practice

As computers become available to more and more people, data collection or intervention messages delivered through the Internet have great potential to reach broader at-risk groups as well as younger generations worldwide. In addition, Web-delivered surveys have demonstrated lower cost per participants in large-scale research projects.[10] The issue of a false sense of anonymity or confidentiality has been raised. However, this perception is likely to change as methods to ensure privacy issues improve.

The current study, which assessed self-reported HIV risky behaviors via different modes of data collection, fills an important gap in the literature. The compatible findings on self-reported behavior patterns related to HIV testing and sexual activities assessed from Web versus paper-pencil modes have significant implications in collecting such information using the Internet. The current study also suggests that the Web-delivered mode of data collection could be more sensitive on measuring extreme or socially undesirable behaviors such as anal sex. In addition, this study also

suggests that age and peer norms might warrant further attention when HIV-related behaviors are examined. With the increasing use of the Internet and its potential to reach the target audience worldwide, findings from this study demonstrate the promise of using the Internet as a compatible tool to collect sensitive health-related information in the future.

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Table 2. HIV-related Risky Behaviors Among Students Participating in the Web Versus Paper-pencil Survey					
	Web Sample		Paper-Pencil Sample		p-value [b]
HIV-related risky behaviors	N [a]	mean (%)	N [a]	mean(%)	
Ever been tested	42	(20.1%)	25	(12.0%)	.023*
Testing intention	209	219.0	215	206.2	.237
Ever ask partner's HIV status	73	(39.5%)	81	(39.3%)	.978
Ever been asked about HIV status	48	(25.7%)	59	(28.2%)	.567
Ever STIs	19	(9.6%)	5	(2.6%)	.004*
Ever engaged in					
-oral sex	174	(83.3%)	189	(89.6%)	.059
-vaginal sex	150	(72.5%)	167	(79.9%)	.075
-anal sex	52	(25.9%)	28	(15.0%)	.008*
Initial age of					
-oral sex	170	177.8	187	180.1	.829
-vaginal sex	147	159.2	166	155.1	.686
-anal sex	52	38.9	28	43.8	.393
Partner numbers					
-oral sex	207	202.9	207	212.1	.417
-vaginal sex	206	194.4	205	217.7	.041*
-anal sex	202	198.8	176	178.9	.014*
Alcohol use					
-oral sex	170	185.3	197	182.9	.823
-vaginal sex	149	175.2	183	159.5	.121
-anal sex	56	118.5	129	81.9	.000*
Condom use					
-oral sex	164	175.5	187	176.4	.868
-vaginal sex	147	172.0	174	151.7	.042*
-anal sex	49	76.6	76	54.6	.000*

Notes:
[a] Students who did not respond to the selected variables were not included. Therefore, the total of students presented in each variable varied accordingly.
[b] Chi-square test was used for categorical variables, and Mann-Whitney U test was used for ordinal variables in the comparisons between two groups.
* p<.05

Table 3. Multiple Regression Analyses [a] of Various HIV-related Behaviors via Different Self-reporting Mode

IV [b] DV [c]	Report Mode	Age	Gender [e]	Race [f]	Peer norms – Oral / vaginal / anal sex
Ever been tested	ns [d]	OR=1.29** 95% CI (1.11, 1.50)	ns [d]	ns [d]	-
Testing intention	ns [d]	ns [d]	ns [d]	ns [d]	-
Ever ask partners HIV status	ns [d]	OR=1.32** 95% CI (1.15, 1.51)	ns [d]	ns [d]	-
Ever been asked about HIV status	ns [d]	ns [d]	ns [d]	ns [d]	-
Ever STIs	ns [d]	OR=1.58** 95% CI (1.22, 2.05)	OR=8.53** 95% CI (2.19, 33.25)	ns [d]	-
Ever engaged in					
-oral sex	ns [d]	ns [d]	ns [d]	ns [d]	OR=3.49; 95% CI (2.48, 4.91)
-vaginal sex	ns [d]	ns [d]	ns [d]	ns [d]	OR=3.74; 95% CI (2.69, 5.19)
-anal sex	ns [d]	ns [d]	ns [d]	ns [d]	OR=2.19; 95% CI (1.56, 3.07)
Initial age of					
-oral sex	ns [d]	ns [d]	ns [d]	ns [d]	ns [d]
-vaginal sex	ns [d]	ns [d]	ns [d]	ns [d]	ns [d]
-anal sex	ns [d]	B(se)=.60 (.13)**	ns [d]	ns [d]	ns [d]
Partner numbers					
-oral sex	ns [d]	B(se)=.14 (.04)**	ns [d]	ns [d]	B(se)=.69 (.07)**
-vaginal sex	ns [d]	B(se)=.19 (.04)**	ns [d]	ns [d]	B(se)=.70 (.08)**
-anal sex	ns [d]	ns [d]	ns [d]	ns [d]	B(se)=.26 (.04)**
Alcohol use					
-oral sex	ns [d]	ns [d]	ns [d]	B(se)=-.84 (.19)**	B(se)=.38 (.07)**
-vaginal sex	ns [d]	ns [d]	ns [d]	B(se)=-.82 (.19)**	B(se)=.46 (.07)**
-anal sex	B(se)=.67 (.18)**	ns [d]	ns [d]	ns [d]	B(se)=.34 (.11)**
Condom use					
-oral sex	ns [d]	ns [d]	ns [d]	ns [d]	ns [d]
-vaginal sex	ns [d]	ns [d]	ns [d]	ns [d]	ns [d]
-anal sex	B(se)=.94 (.29)**	ns [d]	ns [d]	ns [d]	ns [d]

Notes:

[a] Multiple linear regression analysis was used for interval dependent variables and logistic regression analysis was used for dichotomous dependent variables.

[b] IV: independent variables.

[c] DV—dependent variables.

[d] ns: statistically non-significant at alpha=.0025 level (type I error adjusted using Bonferroni correction).

[e] Gender: reference group (male students).

[f] Race: reference group (white students).

** $p < .0025$.

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