
Handheld Computers to Run ACASI to Assess HIV Risk and Deliver Tailored Soap Opera Video Feedback: Acceptability Among Young Adult Urban Women

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The majority of all adolescent and young adult women (90%) with HIV were infected by unprotected sex with an infected male partner (Centers for Disease Control and Prevention [CDC], 2010b). As of 2008, the epidemic had disproportionately affected Black women, who were 14% of the population of women in the United States but comprised 67% of women with HIV infection. It is estimated that in a lifetime, 1 in 30 Black women will be infected with HIV (CDC, 2010a). Innovative approaches to reduce sexual transmission of HIV to this population are needed.

This paper will report on the development of an audio computer-assisted self-interview (ACASI) that was programmed to (a) assess and categorize the level of HIV sexual risk (ranging from no risk to very high risk) by executing an algorithm based on criteria risk behaviors, and (b) deliver video feedback in the form of an entertaining soap opera tailored to the level of HIV risk and type of partner. We tested the accuracy of the prototype to correctly categorize the risk level and deliver the appropriate video. Finally, we compared the feasibility and acceptability of completing the ACASI and viewing the near feature-length video on a small handheld computer to that of a laptop and a desktop using systematic sampling assignment. The objective of

the latter was to compare whether the experience of completing a roughly half-hour long ACASI and viewing a relevant video on the small 4.5-inch screen of a handheld device would be equally acceptable to that of the much larger touch screens of a Tablet Personal Computer (PC; 12-inch screen), or desktop computer (15-inch screen) in a population of young adult urban women.

These results could provide support for the use of emerging small handheld technologies, such as cell phones (available with a 4.3-inch screen), to deliver a video-based intervention, particularly when privacy and portability are desired. This prototype accomplishes the goals of targeting an intervention to a population of urban young adult African American women, and tailoring the message to an individual's HIV risk and type of partner.

Background

With consistent and correct condom use, the risk of HIV sexual transmission is negligible (CDC, 2010c). However, complex relationship dynamics get in the way of successful adherence to risk reduction. Findings by Bell, Atkinson, Mosier, Riley, and

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Brown (2007), indicated that the primary motivation for reducing one's HIV risk was to protect one's partner, but paradoxically, the most important obstacle to reducing one's risk is emotional closeness. Other findings indicated that women may experience pressure to show trust by engaging in unprotected sex, although aware of their partner's risk behaviors (Jones, 2008; Jones & Gulick, 2009). A key problem in promoting condom use is that unprotected sex is perceived to fulfill important relationship-promoting needs (Albarracin et al., 2003; Jones & Oliver, 2007).

Entertainment-Education (EE) is purposefully designed to communicate prosocial norms and behaviors through media entertainment, particularly the soap opera (Singhal & Rogers, 2004). Through the soap opera format, the host of relationship dilemmas, which are addressed through the normative response of high-risk unprotected sex, can be associated with gratifying health promoting options (Jones, 2008). By associating alternative risk-reduction behaviors with normative patterns of risk through associative memory processing, risk-reducing behaviors may be more readily remembered and enacted (Stacy, Newcomb, & Ames, 2000). Because sex scripts are thought to guide sexual behavior (Simon & Gagnon, 1986), sexual health promotion messages can be woven into familiar, emotion-laden contemporary sex scripts as an alternative to normative high-risk sex scripts (Jones, 2006).

This approach was tested in a pilot study of *A Story About Toni, Mike, and Valerie*, a 43-minute soap opera video that communicated HIV-risk reduction in the context of urban women's realistic relationship dilemmas with men (Jones, 2008). The story was based on a content analysis of a series of focus groups with young urban women (Jones & Oliver, 2007). Results indicated that compared to a control group that received a video concerning careers in health care and technology, the intervention group demonstrated a statistically significant reduction in stereotypical gender-based expectations to have sex. Results of the pilot study also provided preliminary support for using a small handheld computer to complete an abbreviated interview and view a near feature-length video in this population.

For the current study, several soap opera scenes were filmed with specific variations in order to tailor

different versions of the video to address lower or higher HIV risk themes for women with main partners. An entirely different video was created to tailor the message to women with non-main partners. The objective was to test the accuracy of the application to correctly categorize risk and deliver the correct video according to the algorithm.

Development of an HIV Risk Algorithm

Defining the level of HIV sexual risk. The purpose of the algorithm developed for this study was to determine an individual's relative level of HIV sexual risk and deliver a relevant video. Branching rules were based on the criteria responses of: (a) the frequency of vaginal, oral, and anal sex; (b) the frequency of condom use; (c) the type of partner (main or non-main); (d) the perception of that partner's risk behaviors during the previous 3 months (sex with other women, sex with men, and injecting drugs); and (e) the occurrence of unprotected sex with multiple partners during the previous year. Three researchers in the field of HIV-risk reduction reviewed these risk criteria.

Sexual intercourse and condom use data were collected in the context of a specific partner, considered to be a more reliable approach than asking these items out of context (Noar, Cole, & Carlyle, 2006). Data on a participant's perception of her partner's risk behaviors were collected for the most important main and/or non-main partner during the previous 3 months. Assessing risk in the context of a relationship reduces the problem of overestimating HIV-transmission risk (Miner, Robinson, Hoffman, Albright, & Bockting, 2002). The problem with "one-approach fits all" is that the health-promotion message is more likely to be dismissed as not relevant (Kreuter & Wray, 2003).

Period of recall. When collecting retrospective data, the objective is to identify a time period that facilitates optimal recall. Time periods may range from the last time the individual engaged in sexual intercourse, the past month, the past 3 or 6 months, the past year, or a lifetime. The retrospective reporting period used in this study was the previous 3 and 12 months. Three months has been recommended for adequate memory recall, while shorter periods

may not be long enough to be representative of behaviors (Noar et al., 2006). Additionally, the number of partners in the previous year was considered to take into account serial monogamy, assuming higher risk if unprotected sex occurred.

Type of sex. Studies vary on how the type of intercourse is measured. Some report vaginal intercourse only; others report specific sex acts (Noar et al., 2006; Schroder, Carey, & Venable, 2003). Data were collected on the frequency (numbers of acts each) of unprotected oral, vaginal, and anal intercourse with a partner in the previous 3 months. Data on unprotected sex during the previous year were asked at the ordinal level (for example, ranging from never to always) because memory recall for specific unprotected sex has been found to diminish with time (Noar et al., 2006).

Tailoring the Message to the Level of Risk

Health promotion may target a population and also tailor the message to an individual's characteristics (Ryan, Skinner, Farrell, & Champion, 2001). Tailoring the health promotion message to a characteristic of the targeted audience is one approach to increasing message relevance (Kiene & Barta, 2006; Kreuter & Wray, 2003; Strecher et al., 2008). One example is the Video Doctor, a computer-based intervention, in which an algorithm provided tailored messages to HIV-infected individuals to reduce substance use and sexual risk behavior. Results indicated a statistically significant reduction in unprotected sex at 6 months and a greater reduction in the number of casual sex partners at 3 and 6 months in the intervention group compared to a control (Gilbert et al., 2008).

In the current study, urban African American young adult and late adolescent women were targeted. The algorithm resulted in a classification of the level of HIV sexual risk that ranged from no risk (abstinence) and negligible risk (consistent condom-protected sex), to very high risk (unprotected anal sex with a partner perceived to engage in a risk behavior). The criteria behaviors triggered feedback in the form of a different version of *A Story About Toni, Mike, and Valerie*. Minor nuances in the storyline of this video had been created to produce

several versions in order to test whether the application would correctly (a) categorize the level of risk according to the algorithm and the type of partner (main or non-main), and (b) deliver the correct version of the video according to the classification of risk level.

Prototype Development

Programming the ACASI. The ACASI was programmed by the technical team for this project. With ACASI, the interview is interactive because the response to a question can determine the next question and skip irrelevant questions. Items were delivered in an audio format over a headset and could also be read simultaneously on the screen. A virtual onscreen numeric keyboard was implemented in HTML and JavaScript on all of the devices (desktops, laptops, and the handhelds) so that the mode of data input on the touch screen was consistent between devices. Participants entered their responses by tapping on the virtual keyboard on the touch screen, directly entering data into the database. Following the algorithm, the level of risk was automatically calculated so that the appropriate video version appeared on the screen upon completion of the interview. The video was programmed to play within the ACASI.

Hardware platforms. The application was installed on a Sony Vaio (VGN-U series) handheld device, a laptop (Toshiba Tablet PC), and desktop computer (Dell Optiplex). Each system ran the same Windows-based operating system.

The Internet and securing the data. To protect data against theft or failure of the device during data collection sessions, the results of the interview were stored locally. When the interview was completed, the anonymous data were automatically uploaded via a secured wireless local area network (LAN) to the study-dedicated remote server. This approach was feasible because there was a landline Internet connection in the vicinity of study activities at each site. By creating a wireless hub, multiple interviews could be uploaded, and participants could be seated with privacy.

On completion of the interview and video, the research assistant (RA) clicked the “upload” button. Data were uploaded using a Secure Socket Layer (SSL) connection. Uploading and downloading data were also secured by configuring the Web server system to use Hyper Text Transfer Protocol Secured (HTTPS). Communication between the Web server system and the database system was secure because these two machines were on the same internal network. In addition, all wireless routers were password protected. To reduce the number of possible entry points for attackers, no ports on the server were opened except the HTTPS port. The servers were physically secured by keeping them in a locked office.

Methods

Evaluation Procedures

A comparative evaluation of the branching functionality, technical performance, feasibility, and user acceptability of the prototype was performed on handheld, laptop, and desktop computers. Data were also collected to conduct a confirmatory analysis of the factor structure of the *Sexual Pressure Scale for Women-Revised* (Jones & Gulick, 2009). Therefore, additional instruments that were not relevant to the algorithm were also included.

Internal testing. Following institutional review board (IRB) approval, a series of internal tests were conducted on the full application on all three systems. Internal testing was performed first by a group of RAs who were able to produce errors and provide valuable feedback related to the usability concerns, particularly in regard to navigation. The branching function of the algorithm was tested by having five RAs follow a predetermined script to respond to questionnaires on each type of computer. Corrections were implemented. Next, beta testing in the target population of 10 women in public housing revealed further problems. Participants would accidentally click on an option and escape from the interview. The solution was to hide the menu bar of the Internet Explorer window. This was accomplished by running the browser (Internet Explorer) in kiosk mode.

After each beta testing phase, a short 1-minute video concerned with “directions on using this computer” was further refined. More explicit demonstrations were provided on how to scroll down or tap on the virtual keyboard. Refinements to the instructions were made until representatives of the target population could follow the interview without technical difficulty during the testing phase. At the end of this process, the “directions video” successfully instructed the user on how to navigate the ACASI. The only questions asked during the study pertained to the meaning of a questionnaire item.

Evaluation study. The main objectives of the evaluation study were to (a) assess the acceptability and feasibility of the ACASI and the videos on handheld, laptop, and desktop computers; and (b) compare the results by the type of computer. It was hypothesized that completing the ACASI and the experience of viewing the soap opera video would be equally acceptable on the handheld as the laptop and desktop computers in the population of young adult urban women.

Study Design

The study followed a cross-sectional design. Participants at each site were sequentially assigned to one of the three groups (handheld, $n = 61$; laptop, $n = 60$; desktop, $n = 60$).

Sample

The sample was 181 urban women, ages 18 to 29 years ($M = 22$, $SD = 3.5$). Inclusion criteria were ages between 18 and 29 and a relationship with a male partner (main or non-main) in the previous 3 months. Based on use of the handheld to run a shorter interview in a previous study (Jones, 2008), a medium to large effect was anticipated (η^2 squared).

Data Collection

After IRB approval, data were collected in two cities in the Northeast United States, at three different public housing developments, a public clinic that tests for sexually transmitted infections, a public recreation center, and a downtown storefront office.

Participants were recruited by the principal investigator (PI) and RAs who were culture, age, and gender representative of the target sample. Recruitment flyers describing the “Women’s Project” were posted or distributed at the study sites. At the housing site, a recruiter who was a resident at the public housing development assisted in notifying age-eligible women about the study and assisted with circulating flyers. A private room was reserved for study-related activities at each site. During the interviews, the PI or RA provided child-care, as needed. Participants at each site were systematically assigned sequentially into each of the three computer groups. Final screening for eligibility was determined by the study team.

A desktop computer, reserved for use by participants in the study, was installed in a private office at each site. Three handheld computers and three of the Tablet PCs were brought to the sites for data collection. The research team had established a wireless network at each site. Access to the hardware was password-protected.

Instruments

Validity and reliability of the instruments had been previously established in this population, and the demographic items had been pilot-tested for clarity (Jones & Gulick, 2009).

The following items were included in the algorithm to determine level of HIV risk: (a) the type of partner (main or non-main), (b) perceived partner risk behavior (sex with other women, sex with men, injection drugs), and (c) the number of times unprotected (vaginal, oral, and anal) sex occurred with this partner in the previous 3 months. Data on the previous year were: (a) number of male sex partners, (b) frequency of sexual intercourse with a man (5 times a week, 3 times a week, once a week, once a month, never), and (c) frequency of condom use, ranging from *Always* (e.g., 4 out of 4 times) to *Never* (0 times).

Relevance of the Video Survey (RVS). The RVS was adapted from Roye and Hudson (2003) concerning the acceptability and relevance of the video content to young adult urban women. The RVS, consisting of 20 items, has a dichotomous response

choice and was completed by the experimental group only. Examples of these items include: *Do the videos about Tony, Mike and Valerie address problems you think are important to women?* and *Do you think the videos could help a woman make decisions about being with a man who won’t use condoms?*

Video on Computer Survey (VCS). The VCS is an 8-item instrument used to evaluate the experience of watching a video on the computer. An example of an item in the VCS is, *Was the size of the computer screen big enough to clearly see the video?* The score is the sum of the items, the higher the score the higher the acceptance of watching the video on the computer.

Computer Acceptability Survey (CAS). The CAS consists of 8 dichotomous items to assess the experience of using the computer to take the interview. An example of an item in the CAS is, *Was the size of the screen big enough to read the words easily?* The score is the sum. The higher the score the higher the acceptability. Two reviewers with expertise in technology reached unanimous agreement on the relevance of the items.

Data Analysis

Differences in the VCS and CAS by type of computer were tested by two one-way ANOVAs with a 95% confidence interval. The results would support or refute the null hypothesis that the acceptability of the ACASI and video on the handheld would not differ significantly from the laptop and desktop computers. The functionality was evaluated by manually calculating the risk category against the computer-assigned risk category for concurrence and to determine that the correct version of the video was delivered.

Results

Of the total sample of 181 women, most self-identified as African American ($n = 156$, 86.2%), the rest as Latina ($n = 7$, 3.9%), White ($n = 2$, 1%), and Caribbean ($n = 7$, 3.9%) or other ($n = 3$, 1.7%). Most of the sample had completed 12 or fewer

Table 1. Categories of HIV Sex Risk for Purposes of Delivering a Tailored Video

Risk Category	Frequency	Percent
No risk: abstains	1	0.6
Negligible risk: condom-protected sex	23	12.7
Low risk: No perceived partner risk, unprotected vaginal sex, 1 partner/year	21	11.6
Low risk: Perceived partner risk, unprotected oral sex, > 1 partner/year	9	5.0
High risk: no perceived partner risk, unprotected vaginal sex, > 1 partner/year	14	7.7
High risk: perceived partner risk, unprotected vaginal sex, \geq 1 partner/year	98	54.1
Very high risk: perceived partner risk, unprotected vaginal and anal sex, \geq 1 partner/year	15	8.3
Total	181	100.0

years of school ($n = 116$, 64%); 44 (24.3%) had completed 1 year of college. The mean age for first sexual intercourse was 15 years (range: 11–21). Concerning relationship partners during the previous 3 months, the majority of the sample ($n = 127$, 70.2%) had been with one main partner. Twenty-five (13.8%) had been with one non-main partner, 24 (13.3%) had been with a main and non-main partner, and 5 (2.8%) reported they had been with a few non-main partners in the past 3 months.

Table 1 shows the HIV sexual risk categories based on condom use and type of sex with partners in the previous 3 months and the number of partners in the previous year. The majority were categorized to be at high risk as a result of having engaged in unprotected vaginal sex with a partner perceived to have engaged in a risk behavior ($n = 98$, 54.1%). Nearly one tenth of the sample ($n = 15$, 8.3%) were categorized as very high risk because they had engaged in unprotected anal sex with a partner perceived to have engaged in a risk behavior. Fourteen (7.7%) were categorized as high risk because they had engaged in unprotected vaginal sex in the previous 3 months, and, although they did not perceive their partners to have engaged in risk behaviors, they reported more than one partner in that year.

Results for the previous year indicated that the majority ($n = 115$, 63.5%) reported they had been

with two or more sexual partners. Of women with sex partners, roughly one fourth had never used condoms ($n = 50$, 27.6%). Just over one fifth (41, 22.7%) had used condoms most of the time, and, similarly, 37 (20.4%) had used condoms sometimes. This means that 128 (71%) had never used condoms or had used them inconsistently. Over one fourth, ($n = 49$, 27%) had always used condoms with partners during the previous year. One participant had abstained and three did not respond on this item.

Hypothesis testing. It was anticipated that use of the computer to view the video and respond to the full ACASI would be equally acceptable between the larger screens of the laptop and desktop and the smaller 4.5-inch screen of the handheld computer. Results of two one-way ANOVAs demonstrated that viewing the near feature-length video, $F(2, 178) = 1.71$, $p = .18$, and completing ACASI, $F(2, 178) = .732$, $p = .48$, did not differ according to the type of computer (laptop, desktop, or handheld) used.

Technical performance. Data provided by the 181 participants were correctly classified into the HIV risk category based on the algorithm. Participants were also assigned the correct video based on HIV risk category and type of relationship partner. All three hardware performed equally well. In general, 167 (92.3%) felt using the computer to complete an interview was better than paper and pencil, while 13 (7.2%) felt there was no difference. One felt that paper and pencil would have been better.

Discussion

An ACASI was programmed to assess and categorize the level of HIV sexual risk and to deliver video feedback in the form of an entertaining soap opera that was tailored to the risk level and type of partner. The results of internal and pilot testing showed that the application correctly categorized the risk level and delivered the appropriate video each time. The feasibility and acceptability of completing the ACASI and viewing a near feature-length video on a small handheld computer was compared to that of a laptop and a desktop. The objective was to assess whether the experience would be equally acceptable in a population of young adult urban women. No significant differences were found between groups

based on the type of computer; reading the print on a 4.5-inch screen, responding on a small number keypad, and the video viewing experience were equal to that of screens nearly 3 times the size.

The findings support the feasibility and acceptability of using small handheld computers, as well as Tablet PCs and desktops to conduct an interactive interview and view full-length videos for young urban women. There are practical advantages and disadvantages to use of each type of hardware depending on the need. For example, if privacy and portability are needed, the handhelds may be the better choice. If a computer is accessible in a community center, the desk top is a solution. Similar to other studies (Pluhar et al., 2007; Schackman et al., 2008), a strength of using ACASI is that it reduces dependency on literacy while enhancing privacy. The result is a higher yield of reported risk behaviors when compared to face-to-face interviews.

Given that 18- to 29-year-old people are typically familiar with mobile devices, the results may well differ in other age groups, limiting the generalizability of these findings. Another limitation is that although partner risk was calculated for unprotected sex with partners in the past 3 months, multiple partners in the previous year was considered a risk without considering the context of the perceived partner risk behaviors. This was done in order to deliver a video with stories that emphasized condom use with multiple partners even though the 3-month risk may have been categorized as low risk.

No other study has compared the acceptability of using small handheld devices in conducting a detailed interview and viewing a 43-minute soap opera video on such a small device when compared to the larger screens of desktops and laptops. These findings lend support to the use of the next generation of small handheld devices, including cell phones, to deliver multimedia health promotion in young adult urban women.

Disclosures

The author reports no real or perceived vested interests that relate to this article (including relationships with pharmaceutical companies, biomedical device manufacturers, grantors, or other entities

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