Participant and Interviewer Attitudes toward Handheld Computers in the Context of HIV/AIDS Programs in Sub-Saharan Africa

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ABSTRACT
Handheld computers have untapped potential to improve HIV/AIDS programs in sub-Saharan Africa, particularly in the collection of survey data. We conducted an experiment in three neighborhoods of Luanda, Angola to assess the impact of the technology on people's comfort and willingness to disclose sensitive personal information, such as sexual behavior. Participants were asked about their HIV/AIDS-related knowledge, attitudes, and practices by local interviewers using either handheld computers or paper surveys. T-tests showed no differences between participants' self-reported comfort across handheld and paper conditions. However, participants in the handheld condition were more likely to give socially desirable responses to the sexual behavior questions than participants in the paper condition. These results suggest that using handheld computers in data collection in sub-Saharan Africa may lead to biased reports of HIV/AIDS-related risk behaviors.

Author Keywords
User study, HIV/AIDS, paper surveys, PDA, handheld computers, technology acceptability, developing country.

ACM Classification Keywords
H5.2 [**User Interfaces**] User-centered design; K.4.2 [**Computers and Society**]: Social Issues.

INTRODUCTION
The HIV/AIDS pandemic has wrought incredible devastation and nowhere more than in sub-Saharan Africa. Rates of HIV infection among adults are as high as 24.1%, 19.6%, 18.8% and 16.1% in Botswana, Namibia, South Africa, and Mozambique, respectively [17]. In contrast, the prevalence of HIV infection among adults is 0.6% in the United States, 0.3% in Canada, and 0.3% in Western and Central Europe [17].

In North America and Western Europe, information technology has greatly improved HIV/AIDS prevention and treatment. For example, extensive information about the disease and about best practices in prevention and treatment are widely available on the World Wide Web. HIV prevention interventions have been tested for video games, public kiosks, web-based tutorials, and cell phones [3,9, 14,20].

However, to date, people in sub-Saharan Africa have not received the same benefits from information technology as people in industrialized nations. There is significant untapped potential to use technology to improve the quality of HIV/AIDS programs in sub-Saharan Africa.

In particular, handheld computers may be used to improve the collection of survey data. These data, such as prevalence of sexual practices that carry high risk of HIV infection, can be used to identify the HIV prevention needs of a community and to evaluate the progress of a program. Use of handheld computers has the potential to improve the speed and accuracy with which the data are collected. In addition, the mobile technology may allow researchers to move more quickly and easily into new locations.

However, the success of using handheld computers in sub-Saharan Africa critically depends on the acceptability of the technology (*i.e.,* user attitude and reaction towards the technology). If it is not favorably accepted, survey respondents may give inaccurate information about their behaviors. Acceptability is particularly critical for HIV/AIDS survey data, because researchers rely on respondents to give accurate information about a highly sensitive topic – sexual behavior. Previous studies confirm that people in Africa are concerned about privacy and confidentiality when it comes to sexual behavior [4,5,19].

Angola, a Portuguese-speaking country in southern Africa, is where we chose to evaluate the acceptability of using handheld computers to collect HIV/AIDS-related sexual behavior data. Though the rate of HIV infection is still relatively low at 3.7% [17], the end of its civil war in 2002 has enabled HIV to spread more quickly through the country. There is a particular urgency for developing evidence-based prevention programs (personal communication, Van Dunem, Vice Minister of Angolan Ministry of Health, May 31, 2005). Like other sub-Saharan African countries, Angola has much to gain from the successful deployment of mobile computerized survey instruments.

However, the lack of access to computers in Angola, and thus the lack of familiarity with the technology, may lead to concerns about the use of handheld computers in the collection of HIV/AIDS-relevant data. Access to computer technology is still low in the country. For example, only 10% of Angolans have a cell phone and less than 2% are Internet users [7]. In contrast, 60% of Americans have cell phones and 68% are Internet users [18].

OVERVIEW OF STUDY

The purpose of this study then was to assess participant and interviewer attitudes toward the use of handheld computers in the collection of HIV/AIDS survey data. We compared their attitudes toward handheld computers with their attitudes toward the standard mode of data collection, paper surveys. The data were collected from November through December of 2005 in Luanda, the capital of Angola. We used structured interviews because of the low levels of literacy in Angola; where approximately 60% of the population have no more than six years of education [1]. Participants were interviewed once, either by interviewers using a handheld computer or paper-and-pencil. However, the same interviewers conducted interviews in both conditions.

METHOD

Study design

To minimize the likelihood that participants would deduce the study design from what they might have seen or heard about the study, we used a block design to assign participants to the handheld or paper condition. On the first day at each locale, all interviews were administered by one mode (handheld or paper) in the morning and by the other mode in the afternoon. On the second day at each locale, the order of the modes was reversed. If a third day of interviewing was necessary, the order of the modes was again reversed. The same measures and procedure were used in both conditions; the only difference between the two conditions was whether the interviewers used handheld computers or paper-and-pencil. Interviewers did not mention anything about the handheld computers unless explicitly asked by the participants.
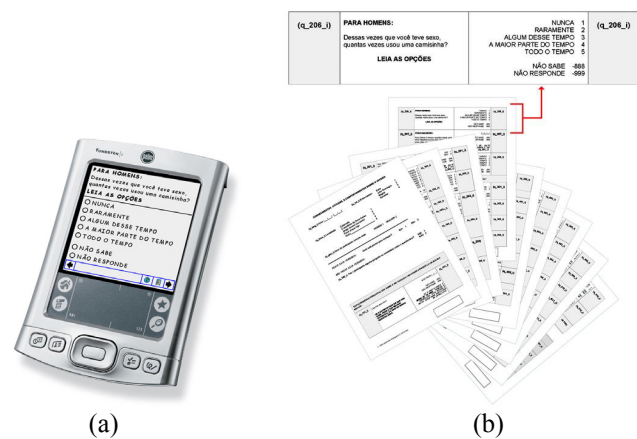

Figure 1. (a) The PalmOne Tungsten E device used by interviewers in the handheld condition. (b) The printed survey used by interviewers in the paper-and-pencil condition.

Apparatus

For the handheld computer condition, we used PalmOne Tungsten E devices. Each device ran the Techneos Entryware v4.2 software [15]. This software displays each question on the handheld computer one at a time; acceptable responses for the close-ended questions are displayed below each question.

For the paper-and-pencil condition, the survey questions were printed in four-column tabular format on nine sheets of paper. All questions asked to participants were close-ended.

Data collection procedure

Interviews were conducted in Luanda, Angola. To gain a broad representation of residents, participants were recruited from three locations of varying socioeconomic levels. At *cybercafés* in the Maianga neighborhood, where residents are primarily of higher education and higher income, interviewers stood outside and recruited from patrons entering and exiting the cybercafés. At the *neighborhood* Bairro Pedelé, where residents are of moderate education and moderate income, participants were recruited from people passing by a local youth center. And at the Estalagem marketplace in the outskirts of Luanda, interviewers recruited participants from the vendors and clients – most of whom are of low education and low income. We restricted the ages of participants to 18-55.

Interviewers approached potential participants in each locale and recruited them to participate in a brief study of knowledge, attitudes, and practices related to HIV/AIDS. The response rate was high; 94% of those recruited agreed to participate. The most common reason given for not participating was lack of time.

All interviews were verbally administered by one of four trained local interviewers (2 men, 2 women). The average age of the interviewers was 26, SD = 4.1. They have been using computers for an average of 5.7 years. None of them had ever used a handheld computer prior to the interviewer training.

The interviews were conducted in semi-private locations and lasted 7-10 minutes. Written informed consent was obtained prior to every interview. Participants were assured that their participation was voluntary and that their responses were completely anonymous.

Upon completion of the interview, participants were given a small incentive (*i.e.,* an engraved pen) and a pamphlet encouraging them to get tested for HIV. The pamphlet listed local sites offering voluntary counseling and testing.

Measures
The following data were gathered in the interviews:

- **Personal characteristics:** Participants were asked their age and years of education completed. Participant sex was recorded by the interviewer.

- **Comfort during the interview:** Participant comfort during the interview was assessed through four questions. Participants rated how comfortable they felt and their ease of understanding the questions. They rated their enjoyment of the interview and their level of anxiety during the interview.

- **Disclosure of HIV-related risk behaviors:** The interview assessed sexual behavior, including condom use, in the past three months with regular partners, occasional partners; and partners in exchange for money or resources. In addition, participants were asked about HIV testing, sexually transmitted infections in the past 12 months, forced sex, and alcohol consumption before sex.

Interviewers provided the following data after completion of each interview:

- **Ease of conducting the interview:** After each interview, interviewers rated the ease of reading the questions, the ease of recording the answers, and the ease of implementing the interview.

In a debriefing session, interviewers also provided qualitative feedback on their experience of using of the handheld computers versus paper-and-pencil in the study.

RESULTS

Participant characteristics
A total of 231 (140 men, 91 women) participants were interviewed. Of those, 118 were interviewed with paper-and-pencil, and 113 were interviewed with handheld computers. The average age was 26, SD = 6.0, and the average level of education was 8.4 years, SD = 3.2.

Comfort during the interview
There were no significant differences between handheld and paper conditions on any of the measures of comfort. In both handheld and paper conditions, participants reported, on four-point scales, high levels of comfort (3.8 vs. 3.8, respectively) and high ease of understanding the questions (3.7 vs. 3.7). They also reported, on three-point scales, high enjoyment of the interview (3.0 vs. 2.9), and moderate levels of anxiety during the interview (1.8 vs. 1.7).

Disclosure of HIV-related risk behaviors
Because we did not have the resources to evaluate the accuracy of participants' disclosure, we instead constructed an index of the social desirability of self-reported HIV-related risk behaviors. Greater social desirability (*i.e.,* presenting oneself in a favorable light) suggests less honest disclosure [2,12].

To construct this index, HIV-related risk behaviors items were recoded +1 if they gave a socially desirable answer (*e.g.,* reporting that they *always* used condoms with a sexual partner); 0 if they were not asked the question based on previous answers; and -1 for all other answers. The final social desirability score was a sum of the nine items.

Analyses showed that participants in the handheld condition gave an average of 2.4 socially desirable responses (out of 9), compared to participants in the paper condition who gave an average of 1.4 socially desirable responses, $t(221) = -2.8$, $p < .01$.

Ease of conducting the interview
Interviewers reported no differences on ease of reading the questions or on ease of recording the answers across conditions. However, interviewers did report, on a four-point scale, greater ease of implementing the interviews in the handheld condition than in the paper condition (3.9 vs. 3.7, respectively), $t(213) = -2.4$, $p < .05$.

Interviewer feedback
In debriefing, interviewers all agreed that they preferred using the handheld over the paper. The main advantage of the handheld was its lighter weight; rather than carrying dozens of paper surveys, interviewers only had to carry two handhelds (one for use, one for backup). One interviewer

Figure 2. The three locations used in this study: the left picture shows the Maianga neighborhood, where the *cybercafés* are located; the middle picture shows the Bairro Pedelé *neighborhood;* the right picture shows the Estalagem marketplace.

stated that she felt more professional when using the handheld. Interviewers also agreed that they found it easy to learn to use the Palm OS and the Entryware software.

DISCUSSION

Computer technology has much to contribute in improving health services and quality of life for citizens in low-resource countries, such as many countries in sub-Saharan Africa. However, research and development of health-related applications for such regions requires a thorough understanding of the users [6,8,11,13]. In these settings, users may consist of people who have never or only rarely use computers. As such, the basic problem of user acceptance of the technology is a critical issue that must be examined as technology becomes more widely available for use in health programs.

Our reported results suggest that computerized data collection in sub-Saharan Africa may lead to biased reports of HIV/AIDS-related risk behaviors, when compared to the traditional method of paper-and-pencil surveys. Though participants reported equivalent levels of comfort in interviews using handheld computers and paper-and-pencil, they nonetheless presented themselves more favorably in the handheld condition than the paper condition. Anecdotal evidence suggests that using the handheld computers may signify high socioeconomic status or that one is an outsider; participants may have wanted to present themselves more favorably to interviewers whom they saw as higher status or as having ties to outsiders. In Angola, in particular, the suspicion of outsiders may stem from the country's isolation during 27 years of civil war. Events during the recent outbreak of Marburg (an Ebola-like virus) in the province of Uíje – where World Health Organization (WHO) researchers with high-tech equipment were attacked by villagers – demonstrated the distrust that some Angolans have of outside health officials and health researchers [10].

Future studies may probe the participants' perceptions of the interviewer and of the handheld computer following the completion of the interview to further understand the impact of survey context on the gathered data [16]. Additional studies may also evaluate the acceptability of "hidden" technology, such as the Anoto pen, for the collection of HIV/AIDS data.

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