Barriers to Acceptance of Personal Digital Assistants for HIV/AIDS Data Collection in Angola

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Abstract

Purpose—Handheld computers have potential to improve HIV/AIDS programs in healthcare settings in low-resource countries, by improving the speed and accuracy of collecting data. However, the acceptability of the technology (i.e., user attitude and reaction) is critical for its successful implementation. Acceptability is particularly critical for HIV/AIDS behavioral data, as it depends on respondents giving accurate information about a highly sensitive topic – sexual behavior.

Methods—To explore the acceptability of handheld computers for HIV/AIDS data collection and to identify potential barriers to acceptance, five focus groups of 8–10 participants each were conducted in Luanda, Angola. Facilitators presented Palm Tungsten E handhelds to the focus groups, probed participants' perceptions of the handheld computer, and asked how they felt about disclosing intimate sexual behavior to an interviewer using a handheld computer. Discussions were conducted in Portuguese, the official language of Angola, and audio-taped. They were then transcribed and translated into English for analysis.

Results—In total, 49 people participated in the focus groups. PDAs were understood through the lens of social and cultural beliefs. Themes that emerged were suspicion of outsiders, concern with longevity, views on progress and development, and concern about social status.

Conclusions—The findings from this study suggest that personal and cultural beliefs influence participant acceptance of PDAs in Angola. While PDAs provide great advantages in terms of speed and efficiency of data collection, these barriers, if left unaddressed, may lead to biased

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reporting of HIV/AIDS risk data. An understanding of the barriers and why they are relevant in Angola may help researchers and practitioners to reduce the impact of these barriers on HIV/AIDS data collection.

Keywords

Computers; Handheld; Data Collection; HIV; Sexual Behavior; Africa South of the Sahara

Introduction

Information technology has greatly improved health services, particularly in high-income countries such as the United States and in Western Europe. For example, information about prevention and treatment of many diseases is widely available on the World Wide Web [1–2]. And, electronic medical records are expected to revolutionize the way that healthcare is delivered [3–5].

However, to date, people in low-resource countries have not received the same benefits from information technology as people in industrialized nations [6–8]. People in this region do not have the same level of access to technology, due in part to the high cost of the equipment, the lack of equipment and applications that are designed for their context, and unreliable sources of electricity (e.g., [8]).

Handheld computers, for example, personal digital assistants (PDAs), may be one solution that can improve the information flow and quality of health services provided in low-resource countries [9]. A number of data collection and informational applications are now available for PDAs. The touchscreen is easy and intuitive to use, with extra functionality provided through the keypad. PDAs operate on long-lasting rechargeable batteries, and in some cases, may be charged using solar panels. Solar chargers performed well in a large household survey in remote areas of rural Tanzania [10]. In addition, PDAs allow health providers to be more mobile, traveling from clinic to clinic or village to village.

However, the success of using PDAs in low-resource countries depends on the acceptability of the technology (*i.e.,* user attitude and reaction towards the technology). There is growing recognition in the literature that user attitudes is critical to the success of informatics solutions [11–13].

Acceptability of a technology for data collection is particularly critical for HIV/AIDS prevention researchers and practitioners, because they rely on respondents to give accurate information about a highly sensitive topic – sexual behavior. Studies confirm that people in low-resource countries are concerned about privacy and confidentiality regarding their sexual behavior [14–16]. Researchers and practitioners who do not adequately demonstrate to respondents that computerized surveys are confidential may not only gather inaccurate data, they may become targets of violence [17]. For example, in Mensch, et al.'s study, researchers entering rural communities in Kenya to conduct sexual behavior surveys with laptop computers were thought to be government spies. While some research has compared the speed and efficacy of using PDAs for health-related data collection, few studies have addressed the social and cultural factors affecting PDA acceptance [18].

The purpose of this study then was to identify potential barriers to acceptance of PDAs in studies of HIV risk in post-conflict Angola. HIV prevalence in Angola is estimated to be 2.1% [19]. Though the prevalence rate is relatively low compared to neighboring countries, such as Namibia, Zambia, and DR Congo, the end of Angola's 27-year civil war in 2002 has increased population mobility and enabled HIV to spread more quickly through the country.

There is a particular urgency for implementing and evaluating HIV prevention programs. Like other sub-Saharan African countries, Angola has much to gain from the successful deployment of PDA-based HIV-related data collection.

To explore the acceptance of PDAs for studies of HIV risk in Angola, we conducted qualitative focus groups with Angolans in the fall of 2005, just a few years after the end of the civil war. Participants were recruited across the range of social and economic strata. We presented PDAs to focus group participants and discussed their concerns with disclosing sexual behaviors to interviewers using a PDA.

Method

Sampling and recruitment

Participants were men and women, between the ages of 18–55, who lived or worked in Luanda, Angola. They were recruited via flyers and face-to-face invitations. To gain a broad representation, participants were recruited from three populations of varying socioeconomic levels: patrons of *cybercafés* in the Maianga neighborhood, where residents are primarily of higher education and higher income; passers-by of a local youth center in the Bairro Pedelé *neighborhood*, where residents are of moderate education and moderate income; and vendors and clients of the Estalagem *marketplace* in the outskirts of Luanda, most of whom are of low education and low income.

The study protocol was approved by the Institutional Review Board at Charles Drew University of Medicine and Science.

Equipment

The handheld computers used in this study were PalmOne Tungsten E devices. The Tungsten E devices are small $4.5 \times 3.1 \times 0.48$ inch units each powered by a 126MHz ARM processor. Each device has a sharp, high-resolution, 320×320-pixel screen and 32 MB of internal memory and runs Palm OS 5.2.

Focus group procedures

The methodology of focus groups was chosen for two reasons: First, the method is acceptable within this cultural context. Previous experience by this research team taught us that many Angolan participants felt uncomfortable and isolated during individual interviews and preferred group interviews. Second, the method is useful for gaining preliminary understanding of an issue when that issue is not highly sensitive [20–22].

In each location, we held two focus groups of 8–12 participants – one for men and one for women. The sex of the facilitator was the same as the participants in that group. Participants were individually told a detailed explanation about the study, and given an opportunity to ask questions. All participants then gave written informed consent, and each participant received an incentive, worth approximately 10 USD, upon completion of the study.

Immediately prior to each focus group, participants were individually administered a brief paper survey by a trained, local interviewer. The goals of this interview were to collect demographic information and evaluate participants' experience with technology, as well as to give many of the participants their first experience with a survey.

When they came together for the group discussion, the facilitators guided the discussion to cover the following topics: how did participants feel about being interviewed during the initial brief interview; what were their reactions when the facilitator presented the Palm Tungsten E handhelds to them; a scenario in which participants were to imagine an

interviewer using a handheld computer to record responses about their sexual behaviors; participants' preferences towards having their responses recorded on paper and pencil or on the handheld computer, and why for the imagined scenario; any potential concerns or problems they foresee with using the handheld computer for HIV/AIDS data collection. The list of topics was developed by the research team and refined with input from the local facilitators to ensure that the topics were culturally appropriate.

Discussions were held in Portuguese, the official language of Angola, and were audio-taped with participant consent. Each focus group lasted approximately one hour.

Focus group discussions were transcribed and then translated into English for analyses. One focus group – women in the Bairro Pedelé neighborhood – was dropped because of procedural inconsistencies. The original Portuguese transcripts from the remaining five focus groups were combined with the English transcripts, so that raters could compare the text in both languages. The transcripts were then entered into Atlas.ti 5.0 to facilitate coding.

Using grounded theory [23], two raters individually coded the transcripts for comments related to comfort with and willingness to disclose sexual behaviors to an interviewer using a handheld computer. Both raters had fluency in English and Portuguese, knowledge of the Angolan cultural context, and the ability to review both the English and the Portuguese transcriptions. When there was doubt about the meaning of a statement, raters referred back to the original Portuguese audio recording to better understand the context of the discussion and the tone used by the speaker. Raters then discussed each coded comment until agreement about the code was reached. Codes were grouped into themes, and their applicability to the research question was assessed. During the preparation of this manuscript, the results of the data analysis were further vetted by other bilingual members of the research team who have extensive familiarity with the Angolan context to ensure that the translated quotes and their corresponding interpretations were consistent with the original meaning.

Results

Table I displays the participant characteristics from each of the five focus groups whose transcripts were analyzed. There were 49 focus group participants, 30 of whom were men and 19 of whom were women. The average age was 25.5 years, and the average number of completed years of education was 8.9. As expected, the participants from the cybercafés were more educated than participants from the neighborhood, and participants from the neighborhood were, in turn, more educated than participants from the marketplace. Participants from the cybercafés had the most experience with technology: all of them have or had a mobile phone, have used a computer, and have heard of the internet. In contrast, the neighborhood and marketplace participants had lower levels of experience with technology. For example, only half of the participants from the marketplace had ever heard of the internet and none of them had ever used a computer.

Participants described a range of perceptions about handheld computers that could be barriers to acceptance. Since most participants had not used a handheld computer before, they based their perceptions on experience with other technological devices or on their beliefs about technology. In addition, handheld computers were seen through the lens of social and cultural beliefs: suspicion of outsiders, desire for longevity, views of progress and development, and status.

Suspicion of outsiders

One perception, and potential barrier, of the handheld computers was that it signaled outsider status. In particular, the men in the marketplace seemed suspicious of outsiders, and the unfamiliarity of the handheld computer made them even more uncomfortable. It took much coaxing from the facilitator for participants to finally explain why they were opposed to using PDAs for collection of HIV/AIDS risk behavior data. One man from the marketplace commented, "It's the first time that this machine is coming here. It can be recording [us]. It can bring suspicion." The facilitator then asked participants to compare the introduction of the handheld computers for data collection to a hypothetical situation in which the Angolan government introduced an electronic registry of children. A man from the marketplace responded, "So a person goes to register his son easily without being suspicious, knowing that it has been announced. Now, this thing that we have never seen, I don't know if it is a recording, a photo, if it is a machine that takes photos… I don't feel comfortable." The lack of introduction to the technology made these participants apprehensive. For these men, their limited familiarity with computer technology, coupled with their role as protectors and guardians of their community, made them more likely to be suspicious of the handheld computers – as these were clearly brought in by outsiders.

Concern with longevity

A second theme that emerged was concern about how well the data were preserved by handheld computers versus paper surveys. These comments reflected a desire for longevity of the data. Though the two groups discussed below came to very different conclusions about which mode of data collection they preferred, there is an underlying theme of longevity that runs through their comments.

The women in the marketplace welcomed the handheld computers because they believed that handheld computers could preserve their data better. This seemed to be based in an exaggerated understanding of the benefits of computer technology. They understood the problems with using paper but did not seem to understand that similar problems faced handheld computers. For example, many of them described the negative impact of rain on paper surveys and indicated a belief that rain would not harm the handheld computers.[1] When asked why she preferred handheld computers, one woman stated, "…because it keeps better than on paper. The paper can get wet, and then all the letters will be erased." Another woman commented, "When we use the paper and a drop of water falls on it, the letters start vanishing. In the device, no, what I am going to say will stay written down on the device." Similarly, another woman noted, "On paper, it can get wet. But there [in the PDA], it can't be forgotten." This concern with the longevity of the data suggests a concern that the women themselves had about not being forgotten.

The men from the cybercafé raised similar issues as the women from the marketplace. However, because they had more experience with computer technology, the men from the cybercafé came to different preferences than the women from the marketplace. In contrast to the women from the marketplace, for example, the men from the cybercafé believed that the paper mode is safer against rain than the handheld computers. One man stated, "The paper is good because you can cover the paper in plastic. This device here, if it rains, the water gets in, and it's finished. On the paper, [the responses] will stay." Another man from the cybercafé reported that the paper surveys would not malfunction, "Paper would be better, because it will be connected with the answers and stored. The computer could malfunction

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[1]Heavy rains are common occurrences in Angola and cause great disruption to daily life. Hence, rain would be a salient environmental concern for people living in Angola.

or be mishandled." Another man from the cybercafé focused on the benefits of using handheld computers for research:

> I like the electronic device better because the information can be disseminated in an easier way. To make an analysis of the research, if it is on paper, anyway the data had to be collected or digitized so that we could analyze it. Now if we used this device, we could do the research much faster.

Another man noted the added security of the handheld computer:

> For a matter of safety I would prefer the devices, because it is important information. Only you can have access to the questions. It can be a password. On paper, you can store it on a shelf and someone can read it as long he has access or forces his way. With this device, it gets harder to do that; that's why I prefer the device.

Views of Progress and Development

When asked whether they preferred that their HIV/AIDS risk behaviors be recorded on handheld computer or paper surveys, people's comments reflected differing opinions about the significance or meaning of computer technology in the Angolan cultural context. Participants who preferred handheld computers indicated that computer technology was important for Angola's development. They seemed excited about the change that computer technology could bring to their country. A man from the marketplace stated that he preferred handhelds, not just because the data stored on a handheld computer is less likely to be lost, but also because use of computers signals progress: "It's worthwhile being computerized. Tomorrow, they can steal your paper, but in the device, it stays forever. Science is progressing and we have to make way for science." A woman from the cybercafé, in response to others' comments about how new technologies take jobs away from people, countered by emphasizing the convenience of the handheld computers: "Personally, I prefer the Palm. I think that advanced technology helps in saving space, that sort of thing, like carrying too many papers in your purse."

Others said that they preferred paper surveys, and their reasoning suggested reluctance toward change and a preference for the status quo. These participants noted that they were more familiar with paper surveys, and that familiarity made them, and presumably, other Angolans, more comfortable. For example, after another participant stated that Angolans will get used to the handheld computers, a man from the marketplace retorted, "I think that since we [already] got used to using papers, it would be better on paper." Similarly, when asked what he liked most about the paper surveys, a man from the cybercafé stated that paper surveys were simpler: "Paper is very good. It's very simple. With [the handheld computer], it gets complicated, right?" Possible benefits of using handheld computers were outweighed by a preference for simple and known ways of doing things.

Concern about social status

The groups with the most education and the most experience with computer technology were more likely to talk about how "others" might fear the technology. For example, a woman from the cybercafé brought up less educated people and how they needed to be introduced to the technology first: "It also depends on the [educational] level….it's unusual to come here to a market lady, the *zungueira*, and hand her a Palm… Before you go there, you have to teach her [how to use it] and you spend more time." A man from the cybercafé echoed similar sentiments that less educated people would feel more discomfort with the handheld computers: "I think that everyone here has a certain [educational] level. Here [in the Maianga neighborhood], I believe that people wouldn't find it strange and would act naturally [with a Palm], but the farther you get from the center, the more difficult it would

get." The farther from the center of the capital city, the less education and income that people have. These participants were making a clear distinction between themselves, who would feel comfortable with the handheld computers, and others of lower status, who would presumably not feel comfortable with handheld computers.

Several people from the cybercafé groups even questioned the appropriateness of using handheld computers to interview those with lower education. A man from the cybercafé said, "This device, it's not for every [cultural] environment. This thing isn't good for everyone, and there are people that having a research questionnaire before them with such a thing [i.e., the handheld computer], they start shaking and they get scared." Another man from the cybercafé agreed, "There are a lot of people, sometimes when they have these things [i.e., the handheld computers] in front of them, they can't speak openly, they get scared." A woman from the cybercafé questioned the value of using handheld computers to interview those with less education, "Well…, with a lady from the market, [the handheld computer] will create a fuss. It's not worth it."

Discussion

Using qualitative data, we identified four possible barriers to Angolans accepting the use of PDAs for HIV/AIDS risk behavior data collection: suspicion of outsiders, concern with longevity, views on progress and development, and concern about social status. While PDAs provide great advantages in terms of speed and efficiency of data collection, these barriers, if left unaddressed, may lead to biased reporting of HIV/AIDS risk data (see [24] for an example). Biased reporting, in turn, will negatively impact researchers' and practitioners' ability to get reliable data from which to develop and evaluate HIV/AIDS programs. Thus, an understanding of the barriers and why they are relevant in Angola may help researchers and practitioners to reduce the impact of these barriers on HIV/AIDS data collection.

The first barrier, *suspicion of outsiders*, has its roots in the 27-year civil war. As in many civil wars, it was difficult to know who to trust. Trust was limited to those within one's community, and outsiders were treated with suspicion. The distrust of outsiders carries on to today and may impact people's willingness to disclose HIV/AIDS risk behaviors to those perceived to be outsiders. Outsider status may be made salient by the use of technology that is unfamiliar. Similar distrust of people using unfamiliar computer technology has been reported in other settings. In the case of Mensch, et al. 2003, researchers with laptops were perceived by community members in rural Kenya as being possible agents of the government with undisclosed motives and ejected from the community. Successful implementation of PDA-based or other informatics solutions in Angola, then, requires that trust be built with community members before implementation begins. Trust is usually developed through relationships and a proven commitment to the well-being of the community.

The concern that one is not forgotten, and by extension, emphasis on *longevity of the data*, may be rooted in the war as well. The civil war from 1975–2002 destroyed practically all infrastructure, including schools, hospitals and health clinics, and government facilities. Today, average life expectancy for Angolans is 42 years and approximately 15% of Angolan children die before the age of five [25]. Under these conditions, people may be drawn to things that offer longevity and stability. Data longevity is one way of ensuring that one's voice is heard and that one will be remembered. In contexts such as Angola, people's beliefs about the capability of a technology to provide data longevity could facilitate or hinder one's acceptance of that technology. To address this concern, researchers and practitioners may consider taking time with respondents before starting data collection to educate them on the

functionalities of the PDA or other data collection technology, focusing on how data is stored.

The concern with *development and progress* may be understood in the context of the rapid and significant changes in recent years. Angola has opened up for increased commerce, return of refugees, and new construction. These changes hold both the promise of newfound wealth and the threat of leaving behind familiar ways of doing things. The evaluation of a new technology, then, may be filtered through one's favorable or unfavorable response to change, as the technology represents the new and unfamiliar. Though the notion that some people embrace new technology and others reject it is not unique to Angola (e.g., diffusion of innovations theory, [26]), the speed of change in a country like Angola may amplify the responses that people have to the use of a new technology for HIV/AIDS data collection. As this concern may not be easily identified, researchers and practitioners may need to probe the root causes of respondents' discomfort, and then to address the concerns through education of the respondents.

Lastly, *concern with social status* can be understood in the context of high population density and limited resources. Though built to house approximately 300,000 residents, Luanda is now a city of more than 6 million inhabitants [27]. During the war, and continuing to today, people migrate to the capital city in search of economic opportunities. Higher social status affords greater access to resources. As the small middle class begins to grow, the pressure is great to differentiate oneself from others of lower class. Access to and having the skills to use computer technology is a valuable resource for advancement in post-war Angola, and may be one way for those of higher education and higher income to differentiate themselves from lower classes. Thus, it is not surprisingly that those of moderate and higher levels of education and income in this study would be reluctant to share those resources with those in the lower classes. One way to address this concern is to hire interviewers or study coordinators (whomever will be interacting with the participants) that are of the same social class as the respondents. However, as it may be costly to hire personnel from each social class, another option is to discuss with interviewers or study coordinators what clothing and mannerisms they could use to help respondents feel more comfortable to disclose their HIV/AIDS risk behaviors.

Determining that handheld computers, and in particular personal digital assistants (PDAs), are culturally acceptable for collecting sexual behavior data has the potential to significantly impact HIV/AIDS research in Angola and other countries in sub-Saharan Africa. Collecting data via PDAs can increase the efficiency of studies that evaluate HIV/AIDS interventions, leading to faster scale-up of proven interventions. This study identified four potential barriers to acceptability of the technology among Angolan respondents. These barriers will need to be addressed when researchers and practitioners use handheld computers for HIV/AIDS data collection.

Limitations and Future Directions

There are several limitations to the current study. First, participants were recruited from three locations only. There may be self-selection as to who visits those locations. In particular, the recruitment in the Maianga neighborhood occurred outside a cybercafé, and there may have been a bias in that sample in favor of people who have more exposure to computers. Secondly, this study was conducted in the capital city. Computer technology is generally more accessible in the capital city, and thus, these findings may not fully represent the attitudes of people in the rural areas. Third, we asked about only one type of handheld computer in the current study. Some cell phones now have the appearance and the capabilities of handheld computers and could be used to transmit data in real-time over cellular networks. Since cellular coverage has grown significantly in the past few years in

many low-resource settings including Angola, cell-phone based technology could greatly improve the speed by which HIV-AIDS-related data can be collected and shared. Future research should address other forms of mobile technology to assess if there are additional concerns that were not identified in this study.

Further research should also assess whether there have been any changes in the barriers and attitudes toward the use of handheld computers in HIV/AIDS data collection in the several years since these data were collected. Though there is greater penetration of mobile computer technology in Angola, many of the underlying social conditions remain constant, suggesting that the barriers identified in this study still exist. The gap between rich and poor continues to be large, making the gaining or maintaining of social status a continued concern for many people. Economic and infrastructure advancements are not equally distributed across the social strata, and in general, health outcomes have not improved for the poor. The concern for longevity likely remains, as well as the polarized views of development and progress. Though the term "outsider" is complex and its meaning may have changed over the past five years, individuals who are invested in the social order may still view outside intervention with suspicion. Further work should address ways to involve local leaders and communities to ensure transparency in research and openness and trust with participants.

Implications for researchers and practitioners

Our team has worked in Angola for nearly ten years, conducting HIV prevention and surveillance activities in partnership with local organizations. These activities include ongoing knowledge, attitudes, practices (KAP) studies and behavioral and serological surveillance (BSS) studies, with the purpose of monitoring level of risk behaviors in the population and evaluating the effectiveness of our programs. As a result of this research, we have applied a number of lessons learned to the way we do our work. For example, in response to concerns about suspicion of outsiders, we only employ local interviewers and we ensure that we have the proper approvals from local authorities before beginning any data collection activities. As much as is logistically possible, we try to match interviewers and respondents in their social class to alleviate concerns about status. To address concerns about being remembered, we prefer to conduct interviews, rather than give self-administered surveys, even with highly educated respondents, as the person-to-person contact may be a way to show that someone cares about their responses.

In addition, based on the findings of this study, we recommend some questions for researchers and practitioners to explore before implementing any computer-based data collection system for HIV/AIDS data in Angola and other sub-Saharan African countries. First, what is the history and social context of this community? What is this community's relationship with outsiders? Is this community welcoming of change or resistant to it? What are people's beliefs and concerns about how data is saved electronically and who has access to the data? What are people's concerns about status? To what degree does access to technology add or take away status? While seeking answers to these questions cannot guarantee acceptance of the technology, the process will go a long way to develop an understanding of this community and to avoid potential resistance to using the technology once data collection has begun.

Summary Table
What was already known on the topic:

- The epidemic of HIV/AIDS is devastating sub-Saharan Africa.

- Accurate and timely risk behavior data is necessary for the development of effective HIV/AIDS prevention programs.

- Handheld computers have the potential to increase the speed and efficiency with which HIV/AIDS data can be collected in sub-Saharan Africa.

- User acceptance is critical to the success of informatics-based solutions in health systems.

What this study added to our knowledge:

- Angolans from a wide range of socioeconomic backgrounds expressed concerns about recording their HIV/AIDS risk behavior data on handheld computers. These concerns fell into four major categories: suspicion of outsiders, concern with longevity, views on progress and development, and concern about social status.

- Concerns about using handheld computers for HIV/AIDS data collection are rooted in the historical and contemporary context of Angola.

- To effectively use handheld computers to collect HIV/AIDS risk behavior data in Angola, researchers and practitioners should assess the community's concerns about electronic data collection and address those concerns before starting data collection.

Highlights

- We asked Angolans to reflect on storing their HIV risk data on handheld computers.

- Concerns about outsiders, longevity, development, and social status were raised.

- Concerns are rooted in the historical and contemporary context of Angola.

- Prior to electronic data collection, learn and address community's concerns.

Acknowledgments

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Table I

Participant Characteristics

| | Cybercafé | | Neighborhood | | Marketplace | |
	Men	Women	Men	Men	Men	Women
Number in group	10	9	10	10	10	10
Mean age in years (SD)	23.8 (4.59)	19.4 (1.23)	25.2 (5.94)	31.6 (6.33)	31.6 (6.33)	26.9 (9.88)
Mean level of completed education (SD)	11.9 (1.85)	11.8 (1.64)	8.9 (2.38)	7.8 (1.47)	7.8 (1.47)	4.6 (2.46)
	(% of sample)		(% of sample)		(% of sample)	
Have ever had a mobile phone	100%	100%	60%	80%	80%	43%
Have ever used a computer	100%	100%	30%	0%	0%	0%
Have ever heard of the internet	100%	100%	100%	70%	70%	30%
Been interviewed in the past	80.0%	20.0%	75.0%	50.0%	50.0%	50.0%