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A Randomized Trial to Evaluate the Efficacy of a Web-Based HIV Behavioral Intervention for High-Risk African American Women

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Abstract

The aim of this study was to develop and test a cost-effective, scalable HIV behavioral intervention for African American women. Eighty-three African American women were recruited from a community health center and randomly assigned to either the web-based *Safe Sistah* program or to a delayed HIV education control condition. The primary outcome was self-reported condom use. Secondary measures assessed other aspects of the gender-focused training included in *Safe Sistah*. Participants completed self-report assessments prior to randomization, 1- and 4-months after their program experience. Across the entire study period, women in the experimental condition significantly increased their condom use relative to controls ($F = 5.126$, $p = 0.027$). Significant effects were also found for sexual communication, sex refusal, condom use after alcohol consumption, and HIV prevention knowledge. These findings indicate that this web-based program could be an important component in reducing the HIV disparities among African American women.

Keywords

HIV prevention; Web-based program; Health disparities; Sexual risk; African; American women

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Introduction

African American women are disproportionately burdened by HIV. Approximately 1 in 32 Black women will be infected at some point in her lifetime as compared to 1 in 526 white women [1]. More alarming, recent data trends indicate that this health disparity is intensifying. In 2008, the HIV infection rate among African American women was 15 times higher than white women. In 2010, that number had risen to 20 times higher [2].

Despite these discouraging numbers, three decades of research have clearly established that HIV prevention works for all groups, including African American women. Indeed, more than 350,000 new infections have been prevented in the United States alone [3]. From these diverse research efforts, the Centers for Disease Control (CDC) have identified a number of effective evidence-based HIV behavioral interventions (EBIs) developed specifically for African American women. This targeting is essential because merely possessing prevention information does not sufficiently reduce risky sexual behavior [4]. Instead, interventions that are theoretically-based and tailored to the life-context of the individual are most effective [5–11]. To help clinicians deliver these tailored EBIs, the CDC provides training and technical assistance (TA) as part of their diffusion of effective behavioral interventions initiative.

Despite 15 years of this coordinated national strategy, EBIs are still not being widely integrated into clinical practices. While there are a multitude of reasons for this, the most prominent is cost. EBIs are typically time and resource intensive, making them incompatible with the reality of community practice [12–14].

In light of these problems, the CDC recently shifted to an approach they call “High Impact Prevention.” While reducing health disparities is a component of this strategy, this initiative fundamentally prioritizes targeted, cost-effective, and scalable interventions. This new focus has resulted in the discontinuation of training and TA for a number of individual- and group-level EBIs developed specifically for African Americans. The most notable example of this is SISTA, a gender-specific and culturally-relevant EBI for African American women. Despite being one of the most requested programs [15], the CDC no longer supports dissemination of SISTA.

Computer-based interventions (CBIs) offer the promise of filling in the gaps previously occupied by human-delivered prevention training. Once developed, CBIs require significantly less staff training and time to implement, increasing their acceptability among healthcare providers [16–18]. They can also be tailored to individual users through the use of integrated risk assessments. This tailoring, plus enhanced anonymity, allows participants to feel more comfortable with computer-based assessments of sensitive information, like high-risk sex or drug use [19], leading to greater disclosure of stigmatized behaviors [20, 21]. CBIs are also delivered with very high fidelity across time and location, increasing their probability of success [16, 22]. Finally, updating materials is less costly and more easily accomplished via the Internet.

Importantly, these advantages do not come at the expense of effectiveness. To the contrary, recent meta-analyses have found that computer-based HIV behavioral interventions yield

significant increases in condom use (Cohen's d = 0.26), significant decreases in incident STIs (Cohen's d = 0.14), and significant decreases in the number of sexual partners (Cohen's d = 0.42) [23]. Furthermore, CBIs increase condom use to the same magnitude as human-delivered interventions [24]. And, similar to human-delivered interventions, CBIs tailored for a single sex are also more effective than those directed at both sexes.

To capitalize on the promise of CBIs to deliver targeted, cost-effective, and scalable HIV prevention among those most severely affected, the current study had three principal aims. First, develop a multimedia, web-based HIV behavioral intervention for high-risk African American women. We named this new program *Safe Sistah*. Second, test the efficacy of the program. And third, develop and test the program in a manner that required very little on-site infrastructure or need for technical support. This was done to facilitate wide-scale adoption and implementation of the program within community health settings.

Methods

Participants

Eighty-three women were recruited from a community health center located in the Anacostia neighborhood of Washington, D.C. Washington, D.C. has one of the highest rates of HIV in the country with 2.4 % of the population infected. Anacostia's population is 92 % African American and has a median family income 54 % lower than the median family income for the rest of the city.

Women seeking sexual health services were recruited over a 6-month period via palm cards placed throughout the clinic's waiting room. High-risk African American woman between the ages of 18 and 50 were eligible to participate. High-risk was defined as either (1) multiple male sexual partners in the past 2 months or (2) inconsistent condom use over that same time frame with a man who was HIV positive, was an injection drug user, had concurrent sexual partners, or had not been tested for HIV since the onset of the sexual relationship. Exclusion criteria included injection drug use (IDU) in the past 6 months, being married, being pregnant (or trying to get pregnant), being HIV positive, or having participated in an HIV prevention class in the past year.

Intervention

The principal aim of *Safe Sistah* is to teach African American women HIV prevention skills adapted to the specific challenges they face in their daily lives. Most notably, 87 % of Black women are infected after having sex with a man. Beyond abstinence, the most effective method to prevent heterosexual transmission is the male latex condom. For a man, using a condom is a behavior. For a woman, it is a goal [25]. Therefore, *Safe Sistah* focuses on condom negotiation, particularly in steady relationships [26]. That is because most African American women are infected by their primary male partner [27, 28]. Yet, condom requests in these relationships are often perceived more negatively than those in new or casual relationships [29]. Several beliefs underlie these negative reactions, including a lack of trust, a lack of intimacy, a lack of pleasure, or the possible presence of disease. Not surprisingly then, studies have shown that there is a greater readiness to propose condom use in new or

causal relationships than in longer-term or primary relationships [30]. *Safe Sistah* prepares women to deal with these condom misperceptions and emphasizes that, in the absence of communication and testing, it is essential to introduce condoms into longer-term relationships.

Despite this training, women may still find themselves with a man who refuses to use a condom. To overcome this, *Safe Sistah* teaches women how to refuse sex in a way that minimizes the potential for intimate partner violence. Along with this, the negative influence of alcohol and other drugs on effective communication and condom use are emphasized with alternative strategies provided to manage those situations. Finally, research shows that positive ethnic identity is related to higher self-esteem and fewer instances of sexual risk-taking [31]. As such, messages of gender empowerment and positive racial identity are delivered throughout the program.

Safe Sistah is fully audio-narrated with a wide-range of multimedia elements including video, interactive exercises, and quizzes. It begins with an opening montage describing how women have made enormous strides in political and economic domains, but how these gains have not always been matched in heterosexual relationships where acceptance of infidelity, poor communication, and physical violence are far too common. From the beginning, the focus is on empowerment and community rather than safe sex or better health. This messaging is reinforced via unscripted videos of African American women who describe the importance of feeling confident and why each is proud to be a Black woman.

The user is guided through the program by the voice and still photos of an African American woman depicted as a “health counselor.” After describing the ubiquity and perniciousness of gender inequalities and the importance of gender-specific prevention skills, the narrator assesses each women across a variety of HIV risk dimensions including number and type of sexual partner (i.e., steady, casual, transactional); frequency of condom use; frequency of anal sex; condom barriers; and quality of partner communication.

All women begin their personalized risk reduction plan with “The 411 on HIV” (designed to increase the understanding of effective prevention methods). Then, based on user-specific risk, she may receive training in the following areas: “Condom isn't a 4 letter word” (intended to increase condom use), “Talking to Your Man” (intended to enhance safer sexual communication), “Things to Avoid” (intended to reduce the sexual risks associated with alcohol and other drugs), “Healthy Relationships” (intended to enhance partner selection and reduce number of partners), and “No Means No” (intended to increase the probability of refusing sex safely).

While each module is individually-tailored depending on the particular risk profile, the same pedagogical sequencing is used throughout. First, the goals and importance of each particular area are briefly described. Next, users receive training in a specific strategy or skill. This might include behavioral modeling opportunities via carefully scripted video vignettes or unscripted videos of African American women describing how they integrated the particular skill into their behavioral repertoire. In this way, self-efficacy is enhanced by allowing a user to vicariously experience success, increasing self-confidence that they, too,

can adopt the target behavior. Finally, the skill is practiced. Most often this is accomplished through an interactive exercise (e.g., identifying the type of negotiation style used in a scripted audio vignette, with accurate responses reinforced and inaccurate responses corrected with further training until success is demonstrated) or a video-based demonstration. While program length varies depending on risk (i.e., more risk, more training), the average amount of time women spent in *Safe Sistah* was 88 min (range 0–344 min). Most women completed the program in one sitting (range 1–6 log-ins). Of the 29 women who accessed the program, 24 (83 %) completed all the material that was assigned to them. Six of those 29 logged-in again to re-review material.

Procedures

Women who received a palm card and were interested in learning more about the *Safe Sistah* study were directed by clinic staff to speak with our on-site coordinator and complete eligibility screening. A total of 195 women were screened: 112 were ineligible while 83 were eligible, agreed to participate, and were immediately consented. Reasons for ineligibility included not high-risk (45 %), recent IDU (12 %), married (13 %), HIV positive (10 %), HIV prevention class in the past year (11 %), pregnant (9 %), or too young (2 %).

Following informed consent, participants were given the option to complete the baseline measure either online or via a phone interview with a research assistant. Subsequent to baseline completion, all women then returned to the clinic to receive payment ($25) and group assignment. Participants were randomly assigned to either the online HIV behavioral intervention (n = 45) or to a delayed HIV education control condition (n = 38). Women in both groups received standard clinical care, including HIV testing and counseling.

Safe Sistah Condition—Participants were given personalized log-in information, a new set of ear buds, and a list of free internet sites around Washington, D.C. (e.g., community centers, public libraries, etc.). They had 1 month to view *Safe Sistah*. At the end of that month, access to the site was blocked. In order to assess behavioral change following program completion, follow-ups were scheduled 1- and 4-months subsequent to access termination. Experimental participants were contacted via phone and were allowed to choose whether to complete the measures online or via the phone.

Control Condition—Participants in the control condition were informed that they would have access to the *Safe Sistah* program upon study completion. Following the same schedule as in the experimental condition, control participants were contacted via phone and given the option of completing the follow-up measures either online or on the phone.

The research assistant was blind to condition for all phone interviews. Participants received $50 for completing the 1-month follow-up and $75 for completing the 4-month follow-up.

Measures

Measures were selected to assess the six *Safe Sistah* training modules described above. The primary outcome measure was self-reported condom use. Consistent condom use was chosen as the primary outcome because it has been shown to substantially reduce the

heterosexual transmission of HIV infection [32]. All baseline measures assessed behavior over the previous 60 days. All follow-up measures assessed the previous 30 days.

Condom Use—Participants were asked to provide information about their five most recent sexual partners during the assessment period of interest, including total counts of vaginal and anal sex acts and the number of times each of these acts included a condom. Condom use was calculated two ways: (1) by dividing the number of occasions condoms were used by the total number of sex acts, and (2) the absolute number of unprotected sex acts.

Sexual Communication—Participants indicated whether they had assessed HIV risk in their five most recent sexual partners during the assessment period of interest on the following seven items: total number of past vaginal sexual partners; sex with a man; sex with a prostitute; frequency of condom use with past sexual partners; concurrent sexual partner; IV drug use; and HIV status. Participants answered on a dichotomous yes or no scale. Sexual communication was calculated by dividing the number of affirmative responses by the total number of items.

Sex Refusal—Sex refusal was measured with a 9-item scale [33, 34]. Participants indicated how sure they were that they would be able to say no to having vaginal sex with a man across a variety of situations: known for few days or less; unknown sex and drug history; dated for a long time; wanted to date again; previous sexual intercourse; wanted him to fall in love; pushing to have vaginal sex; after drinking alcohol; after smoking marijuana. Participants answered using a 5-point Likert scale ranging from (1) not at all to (5) very sure.

Condom Use After Alcohol Consumption—Condom use after drinking alcohol was measured by a single item: “When you drank alcoholic beverages before sex, how often did you use a condom?” Participants answered using a 5-level Likert item ranging from (1) never to (4) always, with higher scores indicating greater adoption of safer sexual practices during high risk situations. A fifth option, not applicable, was provided for those participants who did not have sex following alcohol consumption.

Safer Sex Intentions—Safer sex intentions were measured with a 2-item scale. Participants rated the degree to which they endorsed the idea of having only one sexual relationship at a time and having sex only in the context of a long-term relationship. Agreement was measured using a 4-point Likert scale ranging from (1) disagree to (4) agree, with higher scores indicating greater intent to engage in safer sex. Internal consistency reliability was 0.70.

HIV Prevention Knowledge—HIV prevention knowledge was measured by summing correct responses to 18 true–false items, with higher scores indicating greater prevention knowledge [35]. Internal consistency reliability was 0.73.

Program Ratings—Attitudes about *Safe Sistah* were measured with a 7-item scale at 1-month follow-up. Participants in the intervention condition indicated if the program was easy to use; interesting; clear; if they liked the personalized feedback; if they learned new

things; if they thought that the program could help; and overall, how much they liked *Safe Sistah*. Participants answered using a 4-point Likert scale ranging from (1) strongly disagree to (4) strongly agree.

Demographic Information—Demographic information included age; education (8^{th} grade or less; some high school; high school graduate or GED; vocational or technical school; some college or 2-year degrees; college graduate; more than 4-year college degree); and monthly income ($0–500; $501–1,000; $1,001–1,500; $1,501–2,000; $2,001–2,500; $2,501+).

Statistical Analyses

Our primary hypothesis was that women who used *Safe Sistah* would increase their condom use across all sex acts as compared to women in the control condition. Secondarily, we hypothesized that women who used *Safe Sistah* would also increase their sexual communication with their male partners, have greater confidence that they could refuse unsafe sex, use condoms more often after drinking alcohol, adopt safer sex intentions, and display greater HIV prevention knowledge as compared to women in the control condition.

Following intent-to-treat principles, all participants were included in the analyses, irrespective of protocol violations and events arising post randomization [36]. Baseline and attrition differences between the two conditions were assessed using analysis of variance (ANOVA) for continuous variables and χ^2 for categorical variables. Intervention effects were evaluated using a mixed-design ANOVA with condition (control vs. intervention) as the between subject factor and time as the within-subject (repeated measures) factor. For these analyses, the effect of condition on slope (i.e., condition X time interaction) was the statistic of interest; specifically, the impact of the intervention on the linear trend in the dependent variable scores across time. For the analysis examining program impact on absolute number of unprotected sex acts, we first conducted a cube root transformation of this variable because it was highly skewed at all three time points (all Z_{g1}s > 9).

While we did not anticipate that method of assessment would be associated with reliable differences, we examined this possibility with three ANOVAs. Within each survey administration, assessment method (phone vs. online) served as the between subjects factor on the primary dependent variable. None of these analyses were significant (all Ps > 0.4), with no consistent pattern to these results. Because of this, assessment method was not included as a covariate in any analyses.

Following the recommendations of Singer and Willett [37], we used both last carried forward and group mean imputation techniques for missing data. As the conclusions from both of these methods and from the unimputed results converged, group mean imputed data are presented here.

Results

Baseline

Eighty-three women between the ages of 18 and 50 (mean 35.12; SD 10.1) completed baseline measures and were randomized. Reflecting the impoverished neighborhood in which the community health center is located, this sample was largely poor (85 % made less than $18,000 per year) with low educational attainment (over 1/3 did not complete high school). Most participants (69 %) reported having 1 steady partner in the past 2 months. This did not, however, preclude other sexual partners. Indeed, almost half of the women in steady relationships also reported at least one casual sexual partner.

No significant differences between the control and experimental conditions were observed for any demographic characteristics or for the primary measure of condom use. There was, however, a reliable difference between the groups on one of the secondary outcomes measures. At baseline, women in the experimental condition were more likely to perceive that they could refuse unsafe sex as compared to those randomized to the control condition ($F = 5.83$, $p = 0.019$).

Attrition

Of the 38 women assigned to the delayed HIV education control condition, 89 % completed the 1- and 4-month follow-ups (Fig. 1). Of the 45 women assigned to the online HIV behavioral intervention, 76 % completed the 1-month while 87 % completed the 4-month follow-up.

Women who did not complete the first follow-up had less HIV prevention knowledge at baseline than those who did return ($F = 5.28$, $p = 0.024$). This difference was not observed at the second follow-up, however. At the 4-month follow-up, women with less income were more likely to attrit ($F = 6.43$, $p = 0.013$). There were no other reliable attrition effects found at either follow-up.

Attitudes About *Safe Sistah*

Participants assigned to the online HIV behavioral condition were uniformly positive about their overall experience (see Table 1). In terms of usability, they found the program easy to use, interesting, and clear. They also found it informative, indicating that they learned new information and skills, that the content was personalized to their particular circumstance, and that the information and skills would help them.

Effects of *Safe Sistah*

Primary Outcome—Prior to randomization, the high-risk women in this sample reported using condoms approximately 40 % of the time during vaginal or anal sexual acts (see Fig. 2). At the 1-month follow-up, 72.1 % of sex acts were condom protected for women assigned to the online HIV behavioral intervention as compared to 41.8 % for the control participants. Similarly, at the 4-month follow-up, 59.5 % of sex acts were condom protected for intervention participants compared to only 31.7 % sex acts for control participants. Across the entire study period, women assigned to the intervention condition significantly

increased their condom use relative to controls (F = 5.126, p = 0.027; Fig. 2). There was an indication that these gains were beginning to fade, as denoted by the quadratic interaction term that approached conventional significance (F = 3.412, p = 0.069), though condom use remained significantly higher in the intervention condition than in the control condition at the 4-month follow up.

By relying on condom percentage as the primary measure, it is possible that potentially important information about sexual transmission risk behaviors was obscured. Indeed, participants who engaged in very few sex acts, all of which were unprotected, were treated as equivalent to women who reported a very high number of unprotected sex acts. To explore this possibility, we evaluated the impact of the intervention on the absolute number of unprotected sex acts (see Fig. 3). Across the entire study period, there was a trend for women in the experimental group to have fewer unprotected sex acts relative to controls (F = 2.819, p = 0.098). There was also an indication that this marginal effect was beginning to fade out by the 4-month follow-up, as indicated by the quadratic interaction term (F = 4.093, p = 0.047).

Secondary Outcomes—Table 2 summarizes the results of the repeated measures ANOVAs for all outcomes. Relative to controls, women in the experimental group significantly increased their sexual communication across the entire study period (F = 4.735, p = 0.033). Similarly, intervention participants increased their condom use after drinking across the study trial as compared to controls (F = 8.541, p = 0.007). There was no evidence, however, that the program was effective at increasing HIV knowledge, safer sex intentions, or self-efficacy to refuse unsafe sex (all n.s.) across the study period.

Post-Hoc Analysis—A number of studies investigating the impact of computer-based HIV behavioral interventions report positive short-term effects that dissipate in as little time as 1 month [38, 39]. To examine this possibility, we conducted post hoc ANCOVAs for each of the three non-significant secondary outcomes. For each, the baseline measure served as the covariate, with the first follow-up the dependent variable. Relative to controls at the 1-month follow-up, women in the experimental group had significantly greater HIV knowledge (F = 4.19, p = 0.044) and had greater confidence that they could refuse unsafe sex (F = 8.56, p = 0.004). There was no reliable effect, however, on safer sex intentions (F = 0.19, p = n.s.).

Discussion

Results from this randomized trial demonstrate that a computer-based behavioral intervention can significantly reduce the risk of HIV infection among a group of high-risk, economically disadvantaged African American women. Women assigned to use *Safe Sistah* increased their condom frequency by 63 % in the first month following program completion and were able to maintain these gains throughout the entire study period relative to control participants. This behavioral change is vitally important because consistent condom use can reduce seroconversion by 80 % among HIV serodiscordant heterosexual couples [32].

While consistent condom use was the primary goal of the intervention, there were other important ancillary aims. Most notably, a key feature of many EBIs for women is to enhance sexual communication and negotiation [4, 40–42]. Likewise, *Safe Sistah* includes training in how to talk to men about their sexual risk. Before using the program, the women in this sample did not thoroughly assess HIV risk in their male sex partners. This changed, however, following program completion. Across the entire study period, women assigned to the program group were much more likely to ask the men they were having sex with how often they used condoms with their previous partners, if they had used intravenous drugs, and their current HIV status.

Another key prevention challenge is reducing the impact of alcohol on sexual decision making. Indeed, both problem drinking [43] and non-abuse consumption [44] are associated with lower condom use among African American women. To combat this, *Safe Sistah* teaches women about the deleterious influence of alcohol in lowering sexual inhibitions and interfering with safer decision making. The program takes a harm reduction approach by providing a number of strategies aimed at increasing condom use subsequent to planned drinking. First, women are encouraged to carry condoms in these situations. In addition, they are cautioned that they may face enhanced male resistance to condoms due to greater intentions to engage in unprotected sex and concerns about erectile dysfunction [45]. Women are given a range of strategies to combat these barriers (e.g., integrating condom application during foreplay, dirty talk, putting the condom on him, responses to common condom excuses), and encouraged to practice these strategies outside of drinking situations. Consistent with this approach, intervention participants significantly increased their condom use after drinking as compared to controls.

To our knowledge, only one other study has investigated the impact of a computer-based HIV behavioral intervention specifically tailored for African American women [46]. In this previous investigation, young African American women between the ages of 21 and 29 years old were scheduled for 2 weekly, 1-h clinic appointments to use the CBI. Each weekly appointment was also accompanied by a 15-min, small group session led by an African American female health educator. These group sessions focused on proper condom use and communication techniques. Similar to our findings, women who participated in weekly CBI appointments plus small group sessions reported significantly higher levels of condom-protected sex acts as compared to controls.

While this previous study was an important first step, it failed to address critical adoption barriers that exist in public health settings. Specifically, by requiring all participants to come into the clinic for two, 1-h appointments, the time and spatial flexibility of that intervention was severely restricted. More importantly, it is unclear if the observed changes in condom and communication skills observed in this previous study were due to the human-delivered (i.e., inclusion of small-group sessions) or computer-delivered components. Indeed, previous research with inner-city African American female clinic patients demonstrated that a single 20-min culturally-sensitive, gender-appropriate session led to more consistent condom use and fewer incidents of sexually transmitted infections at 12-month follow-up as compared to control [40]. Independent of this ambiguity, the requirement to access the program at the clinic (thereby requiring both space, staffing, and computer resources), the inclusion of a

small group session, and the inclusion of only young women significantly reduces the scalability of this earlier study.

To address the persistent and growing racial health disparity in HIV incidence among women in the United States, we sought to develop and test the efficacy of a theoretically-based CBI specifically tailored for African American women. Beyond that, it was essential that the program be applicable to the entire adult reproductive lifecycle and that its implementation be consistent with the limitations of community practice. Indeed, the CDC has articulated six key components to effective public health program implementation: innovation, technical package, performance management, public- and private-sector partnerships, communication, and political commitment [47]. *Safe Sistah* is designed to include most of these components. Namely, it is highly innovative, developed using empirically-validated, theoretically-based behavioral principles delivered using the latest technology. It is a self-contained technical package that does not require any instruction or clinic infrastructure in order for the target audience to reap significant public health benefits. It also includes real-time monitoring of program access and progress (i.e., automated performance management). Finally, it was developed and tested as a part of a public–private partnership.

What remains an exciting area of future study is developing a CBI that includes the final two strategies for reducing HIV health disparities: enhanced communication and political commitment leading to public health action. While there is a dearth of studies examining the latter component, work is beginning to appear that addresses the former. For example, one study used a trained peer counselor who spent 8 h a day in an online chat room frequented by men who have sex with men (MSM) [48]. This chat room was a place where MSM engage in social and sexual networking. The peer counselor provided information about HIV testing. Initial pilot testing indicated a significant increase of HIV testing among the chatters. Another study reached out to youth of color via Facebook [49]. Participants were randomized to either an HIV education condition or control condition that featured posts of current events. At 2-month follow-up, condom use among the intervention group increased, but these effects were nonsignificant at 6 months.

Our team is currently investigating ways to harness computer-based approaches to spur political commitment at the clinic level. Typically, these efforts are focused on building broad coalitions within civil society organizations and government to ensure proper funding of programs or to overcome opposition from specific interest groups. While this is essential, it is also clear that key stakeholders at both the coordinator and organizational levels within public health settings need to be engaged [50]. We are developing a computer-based educational program designed to help health providers integrate CBIs into their clinical practice. A primary objective is to enhance belief in the applicability, acceptability, and efficacy of CBIs. Another key aim is to help staff conduct organizational planning before implementation. The goal is to identify and eliminate any potential barriers (e.g., space for computers, qualified coordinators) before rolling out the intervention. By providing these adoption and integration strategies, we hope to increase commitment at the clinic level.

A separate, but equally important, issue is how to maintain long-term political commitment by key stake-holders within public health settings. This question focuses not on the initial adoption and integration of computer-based approaches, but instead acknowledges that even successful programs can be discontinued for a myriad of reasons. Further research should explore the technical, financial, and staffing requirements necessary to maintain long-term CBI implementation [51].

The durability of these findings is another important area for future research. The inverted-U pattern of the condom data, as well as the post hoc analyses, seems to argue for the potential benefit of supplementing the intervention with booster sessions. These brief reviews or reminders would occur after completion of the main intervention to combat potential fading of effects. Previous research has documented the effectiveness of booster sessions as part of HIV behavioral interventions [52–56].

One potential way to deliver this booster messaging is via short message service (i.e., texting). Text messaging has two important characteristics. First, it works. Text messaging-based health promotion interventions have been shown to be effective across a variety of health behaviors, with message tailoring and personalization associated with greater efficacy [57]. Second, it is popular. Ninety-two percent of African Americans own a mobile phone, and 85 % of those owners report text messaging. Importantly, mobile phone uptake remains a robust 86 % among those with a high school degree or less, and 90 % among those making $30,000 or less [58]. Targeted, personalized messaging that enhances feelings of empowerment and reinforces previous learning may be one relatively low-cost, scalable solution to maintaining intervention gains among African American women.

Several limitations of this study should be noted. First, a placebo attention control condition was not part of the design. Ideally, the women assigned to the control condition would have received computer-based education that did not include HIV behavioral training. Without this, we cannot definitely conclude that the results of this study are not simply due to using a multimedia computer-based program irrespective of content.

Another concern is the reliance on self-reported condom use as the primary dependent variable. Several studies have examined this issue by assessing interpartner concordance as a marker of condom self-report validity. These studies have found that independent partner agreement is high for reports of vaginal sex, anal sex, and condom frequency [59–62] and this is true specifically among African American couples [63]. Despite this, clinic records or biological endpoints would strengthen these findings.

A third concern is the relatively small sample size over a short period of time. Indeed, several of the secondary measures (i.e., sex refusal, safer sex intentions, and knowledge) were significant at Time 1 but not across the entire study period. It is unclear whether the condom findings would similarly decay if assessed a few months later. Future studies should include longer time-frame of assessments and investigate the possibility of including booster sessions to bolster the positive effects.

A final concern is that 12 % of interested participants were excluded due to intravenous drug use. This is important because substance abuse has bothdirect, via IDU, and indirect,

through impaired judgment and reduced sexual inhibitions, linkages to higher HIV rates [64]. Indeed, the disproportionate impact of HIV on African American women is further augmented among those who use drugs [65–67].

Recognizing this, Sterk and her colleagues developed an HIV behavioral intervention specifically for African American women who use crack or inject drugs [41, 68]. While it includes components not found in *Safe Sistah* (e.g., safer needle practices), even in areas of overlap, the skill development in this intervention is uniquely tailored for the particular needsof drug-using women. For example, the importance of positional bargaining power is emphasized as a key concept in their condom negotiation training. They argue that women who are high, experiencing craving, or going through withdrawal put themselves in more vulnerable positions, and are less likely to convince a man to wear a condom. Participants who were randomized to the Sterk intervention reported increased condom use with steady partners and reduced number of drug injections at the 6-month follow-up. We are currently computer-adapting a version of this HIV behavioral intervention.

Conclusion

There is a clear and compelling need to reduce the HIV disparities that affect African American women. Results from this study provide support for one potential solution. High risk African American women reduced their frequency of unprotected sex, mitigated the negative influence of alcohol use on sexual risk, and increased communication with their male partners after using a culturally-appropriate, gender-specific computer-based HIV behavioral intervention. That these positive findings occurred with only nominal clinical support among an economically disadvantaged population further bolsters the belief that technology offers the promise of integrating the reach of public health approaches with the results of intensive, personalized clinical interventions in a cost-effective fashion.

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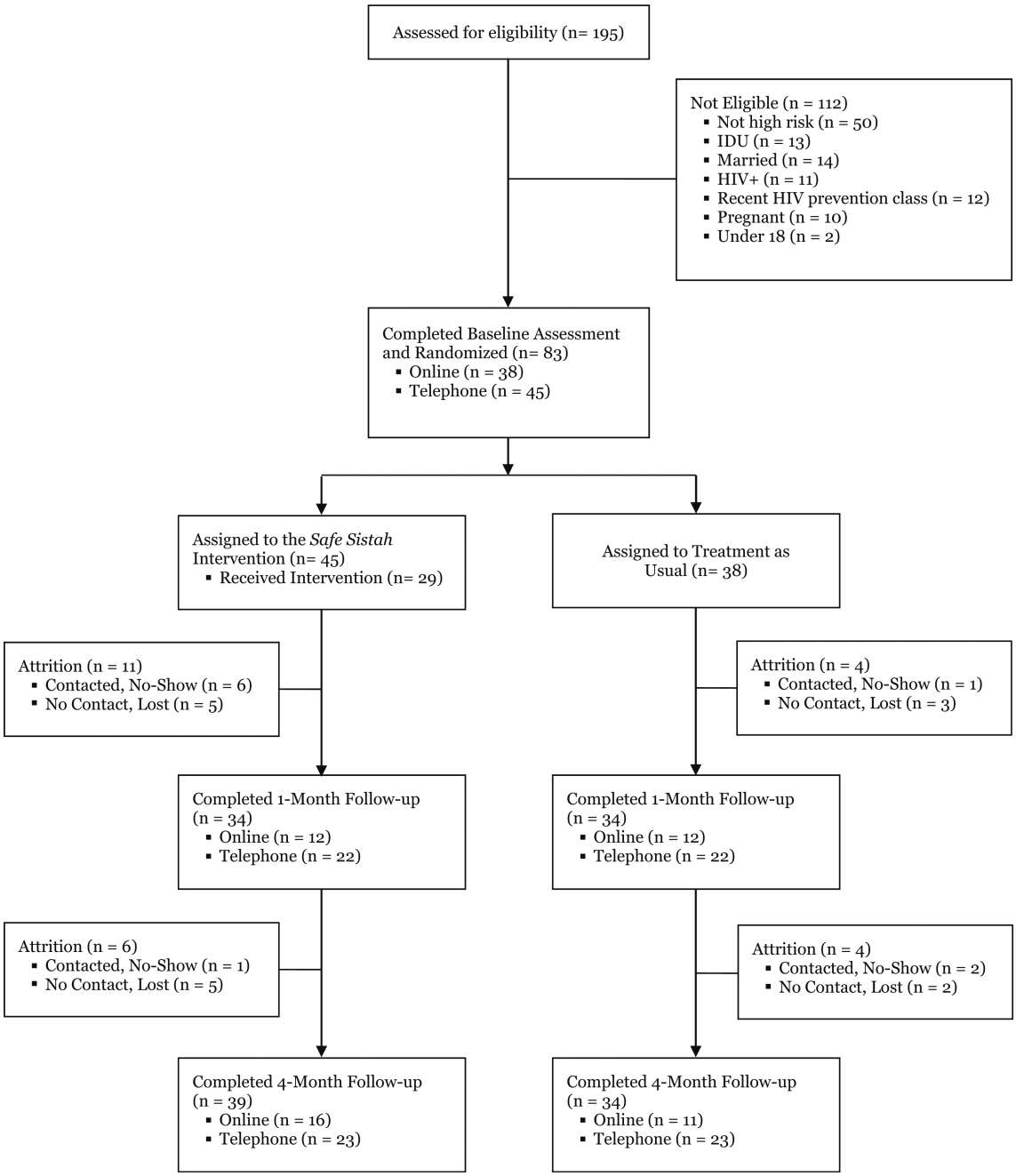

Fig. 1.
Flow of study participants

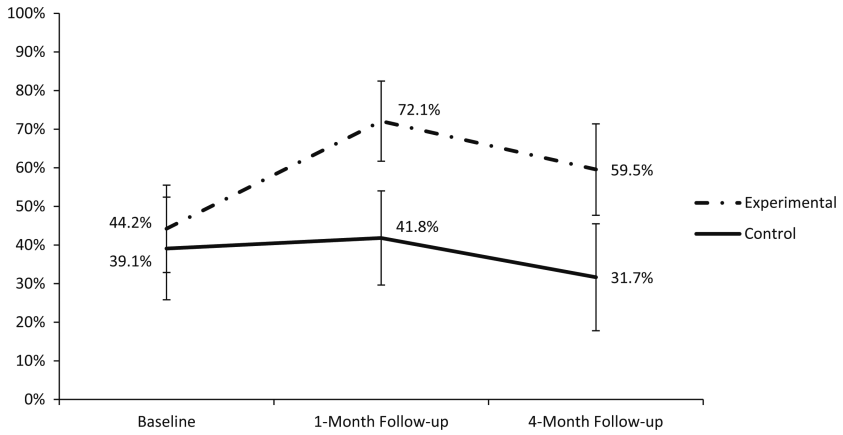

Fig. 2.

Percentage of condom-protected sex acts over time by condition

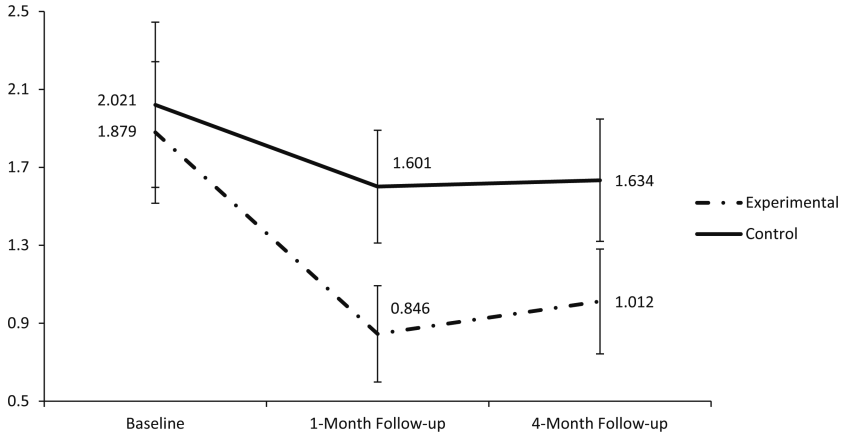

Fig. 3.

Absolute number of unprotected sex acts over time by condition

Table 1

Attitudes towards *Safe Sistah*

Item	Mean	SD
Overall liked	3.28	0.68
Easy to use	3.36	0.76
Interesting	3.28	0.74
Clear	3.28	0.74
Liked personalized feedback	3.32	0.75
Learned new things	3.24	0.78
Program can help	3.36	0.76

Table 2

Mixed-design ANOVA results for all outcomes

	Baseline		1-Month follow-up		4-Month follow-up		Time X condition linear contrast[a]		Time X condition quadratic contrast	
	Intervention mean (SD)	Control mean (SD)	Intervention mean (SD)	Control mean (SD)	Intervention mean (SD)	Control mean (SD)	F	p	F	p
Condom use	44.22 (37.41)	39.10 (34.95)	72.08 (32.17)	41.80 (35.19)	59.54 (40.40)	31.66 (34.69)	5.126	0.027	3.412	0.069
Unprotected sex acts	1.88 (1.21)	2.02 (1.10)	0.85 (0.71)	1.60 (0.89)	1.01 (0.90)	1.63 (0.82)	2.819	0.098	4.093	0.047
Sexual communication	60.1 (35.1)	55.2 (32.5)	75.9 (28.0)	64.5 (30.2)	81.0 (23.5)	68.0 (33.1)	4.735	0.033	1.588	n.s.
Condom use after alcohol consumption	2.4 (1.3)	2.0 (1.15)	3.21 (1.01)	1.78 (0.75)	3.11 (1.06)	1.45 (1.01)	8.541	0.007	2.108	n.s.
Sex refusal	3.81 (1.07)	3.47 (1.07)	4.21 (0.67)	3.63 (0.91)	4.26 (0.79)	3.94 (0.59)	0.003	n.s.	1.925	n.s.
Safer sex intentions	3.24 (0.99)	3.1 (1.04)	3.43 (0.87)	3.33 (0.70)	3.63 (0.64)	3.56 (0.78)	0.091	n.s.	0.001	n.s.
HIV prevention knowledge	11.31 (4.21)	11.18 (3.63)	13.59 (2.79)	12.19 (3.51)	13.59 (3.37)	12.79 (2.85)	0.523	n.s.	1.486	n.s.

[a]The impact of the intervention on the linear polynomial is the principal statistic of interest