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Use of Technology for HIV Prevention among Adolescent and Adult Women in the United States

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Abstract

Although the proportion of new HIV infections in the United States among women has decreased over the last few years, still, approximately 20% of new infections occur annually among adolescent and adult women. The development of effective evidence-based prevention interventions remains an important approach to further decreasing these numbers. Technology-delivered prevention interventions hold tremendous potential due, in part, to their ability to reach beyond the walls of brick-and-mortar intervention sites to engage individuals where they are. While most technology-delivered interventions have focused on adolescents and men who have sex with men, much fewer have specifically targeted adolescent or adult women despite evidence showing interventions tailored to specific target populations are most effective. We summarize the recently published literature on technology-delivered HIV prevention interventions for U.S. adolescent and adult women and provide suggestions for next steps in this nascent but emergent area of prevention research.

Keywords

HIV; technology; technology intervention; prevention; women; adolescent

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Conflict of Interest

Dr. Blackstock, Dr. Patel, and Dr. Cunningham declare that they have no conflict of interest.

Compliance with Ethics Guidelines

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

Introduction

Each year in the United States (U.S.), African Americans and Latinas comprise about 80% of adolescent and adult women newly infected with HIV [1,2]. Additionally, women with or at high risk for HIV are disproportionately socioeconomically disadvantaged; among those with HIV, most contract the infection via heterosexual contact [3]. The ability of evidence-based face-to-face behavioral interventions to ameliorate existing HIV-related disparities in the U.S. has been limited by a number of factors including cost of implementation and lack of reach [4]. Consequently, the appeal of technology-delivered behavioral interventions has continued to grow, fueled in part by the increasing popularity of mobile devices [5]. The ubiquity of digital media technologies such as cellphones and tablets have helped to narrow the “digital divide” in the U.S. [6]. A meta-analysis found that technology-delivered HIV behavioral interventions were more efficacious if they targeted men or women, but not both; moreover, those that focused specifically on women demonstrated large effect sizes, suggesting a benefit of tailoring technology-based interventions to specific populations [4]. Yet, despite the potential of technology-delivered behavioral HIV prevention interventions, the vast majority have not specifically focused on adolescent or adult women [7–10].

In this paper, after overviewing the patterns of technology use among U.S. women with or at risk for HIV, we summarize the recently published literature about technology-delivered prevention interventions for U.S. adolescent and adult women as well as technology-delivered interventions specifically designed to promote health among U.S. women living with HIV. We provide suggestions for future research directions in this area.

Patterns of technology use among adolescent and adult women with or at risk for HIV

High levels of technology use among adolescents have been widely recognized, and the data examining the association between technology use and HIV risk behaviors have been rapidly accumulating. A study of both female and male African American adolescents found frequent cellphone use was associated with sexual sensation seeking, risky peer sexual norms, and impulsivity [11]. Frequent Internet use was associated with a history of sexual activity as well as sexual sensation seeking. A subsequent study by the same authors found that 6% of adolescents met sex partners online and this behavior was associated with high risk sexual and drug use behaviors [12]. Adolescent females were less likely than their male counterparts to report having sex with a partner met online.

While technology use among adolescents at risk for HIV has been well characterized, data are more limited for at-risk adult women. In a cross-sectional study of 200 female attendees to a clinic for sexually transmitted infections (STI) (mean age 27 years old; range 18–62, 87% African American), 80% reported any Internet use with about one-third of Internet users going online daily [13]. Ninety-three percent of the sample owned a cellphone and 79% used text messaging. Use of each of the three modalities (Internet, cellphone, text messaging) was associated with younger age and higher educational attainment. However, compared with younger women, older women were less likely to want to receive health advice via text messaging.

Only one study has specifically examined technology use patterns among HIV-positive women in the U.S. In a cross-sectional survey of HIV-positive women from urban community-based organizations, the proportion of current Internet users was lower than that of the general population (61% vs. 84%) [14]. Among Internet-using women, 87% owned a cellphone, 41% a laptop computer, and 29% a desktop computer. In unadjusted analysis, compared with non-users, Internet users were more likely to be younger, have higher socioeconomic status, and lower health-related social support. The primary reasons for non-use were lack of computer/Internet access and navigation skills.

In summary, adolescents have high rates of technology use, and compared to those with less frequent use, adolescents with more frequent technology use may be more likely to participate in high risk behaviors. Among adult women with or at-risk for HIV, limited data suggest that most own cellphones and engage in text messaging. Overall, findings suggest that technology-delivered interventions may be more acceptable to adult women who are younger and of higher socioeconomic status. Additionally, as adult women with HIV appear to have lower rates of Internet use than the general population, interventions may enhance their acceptability by providing access to cellphones and other electronic devices as well as by incorporating computer/Internet skills training to address limited digital literacy among participants.

Literature Search Method and Criteria for Inclusion

A comprehensive literature search was conducted in PubMed to identify studies relevant studies published January 2011 to June 2015. The search was conducted using combinations of the following terms: women, females, HIV, AIDS, intervention, internet, online, video, electronic health, ehealth, mobile health, mhealth, mobile phone, smartphone, cell phone, app, application, text, text message, social media, web, web 2.0, and technology, and was limited to English language manuscripts with available abstracts. We included articles if (a) U.S. adolescent and/or adult women were the target population, (b) the study involved the evaluation of an intervention using pre-post experimental or randomized controlled trial design, and (c) a specific technology was the method of intervention delivery. For the purposes of this review, we excluded studies of large-scale mass media interventions.

Results

We identified 11 studies published from 2011 through 2014 that met our search criteria. Table 1 provides a description of study population, design, intervention description, and results. Most were randomized controlled trials ($n=9$) and focused on primary HIV prevention among adolescent or adult women. Intervention delivery platforms that were used fell into three main categories: phone- and mobile-based technology (e.g., videophone, smartphone), computer-based technology (including hybrid in-person interventions), and the Internet. The majority demonstrated efficacy of the interventions on outcomes such as HIV/AIDS knowledge and risk behaviors.

Populations targeted

Most of the recently published technology-delivered intervention studies targeting adolescent and adult women focused on primary HIV prevention. Fewer studies focused on secondary HIV prevention among adult women and none specifically targeted HIV-positive adolescent women. Most of the studies in our review specifically recruited African American adolescent or adult women or had samples in which the majority of women were African American. This is likely due to the fact that African American adolescent and adult women are disproportionately represented among women with or at-risk for HIV. Several of the studies that focused on adult women recruited younger adult women (younger than 30 years), however most did not specify an age cut-off. Recruiting younger adult women may have been in response to lower rates of technology among older adult women.

Phone- and mobile-based technology

We identified two studies which used telephones as the primary delivery platform for the intervention: one of which provided phone-based HIV/STI prevention counseling to adolescent women and the other which used videophones to deliver a group-based risk reduction intervention to at-risk women. Two other studies utilized mobile handheld devices to deliver videos to participants, one to reduce to HIV-related stigma among HIV-positive women and the other to reduce HIV risk behaviors among at-risk women

Phone-based counseling

While phone-based counseling is not new, the proliferation of cellphones, particularly, among adolescents, has now enabled interventions using this type of counseling to have more widespread reach to sustain behavioral change. In a randomized controlled trial (RCT) of African American adolescent girls, DiClemente et al. tested the efficacy of telephone-based HIV/STI prevention counseling over a 36-month period [15]. At baseline, both study arms participated in a one-session face-to-face evidence-based STI/HIV intervention. Thereafter, those in the intervention received a brief 10-minute call with tailored risk reduction counseling every 8 weeks, while those in the control arm received calls about general health information. Compared to control arm participants, intervention participants were less likely to have an incident STI and to have risky sex.

Video-group using videophones—Technology-delivered prevention interventions reflect an attempt to address the limitations posed by face-to-face interventions. For example, many evidence-based interventions promoted by the Centers for Disease Control and Prevention (CDC) meet for multiple sessions and require substantial time and personnel availability. To address these challenges, Marhefka et al. conducted an RCT at community sites (e.g., AIDS service organizations) examining the efficacy of a video-group version of Healthy Relationships, an evidence-based intervention for women living with HIV (HR-VG) [16–17]. HR-VG involved participants using non-portable videophones requiring Internet access at the community sites. Interestingly, formative research indicated that due to confidentiality and privacy concerns, participants preferred to engage in video-group with a facilitator at trusted locations such as community-based organizations as opposed to at home [18]. Intervention content included video clips to stimulate discussion around disclosure and

sexual behavior, role playing, and instruction in condom application. The intervention was delivered via videophones over six 2-hour sessions during a 2-week period and had high levels of satisfaction. Compared with control participants ($n=35$), at 6-month follow-up, intervention participants ($n=36$) reported significantly fewer episodes of unprotected sex over the prior 3 months.

Video delivery via mobile handheld device—We identified two studies which employed mobile devices to deliver videos to participants. Barroso et al. conducted an RCT involving HIV-positive women in the South to test the efficacy of weekly video in reducing HIV-related stigma [19]. The video portrayed HIV-positive women (actors) discussing a number of relevant themes including life as an HIV-positive woman, fear of disclosing HIV status, and the importance of communicating with people they trust. Both intervention and control participants received an MP4 player (iPod Touch). Intervention participants received a brief tutorial about how to use the device and were instructed to watch a 45-minute video weekly for the first 4 weeks, then as desired for weeks 5 to 12. They were also asked to record their time spent viewing the videos in a log book. Control participants received iPod Touch devices without content loaded on it. At 90 days, a significant reduction in stigma scores as well as improvements in self-esteem and coping self-efficacy scores were observed. Moreover, women in the study felt the device itself enabled them to watch the videos without concern for inadvertent disclosure of their HIV status.

We found only one recent study specifically targeting women that utilized smartphones as the primary intervention modality. In this RCT, 18-to-29-year-old at-risk women received 12-weekly soap opera video episodes or 12-weekly HIV prevention text messages, both delivered to smartphones [20]. Soap opera episodes lasted 15–30 minutes and provided plot lines that illustrated how to deal with common high-risk relationship situations. Participants were provided with smartphones (Motorola DROID) and training [21]. Notably, participants could use smartphones to access the Internet including social media and, unlike the prior study, participant time spent viewing videos was automatically recorded by the device itself; however, phone and texting capabilities were disabled. The soap opera video series had high levels of satisfaction and most participants viewed all episodes. Participants in both arms experienced significant reductions in unprotected sex with a high risk partner, with no difference between arms.

Overall, we found that intervention studies involving phone- or mobile-based technology utilized such technologies in both conventional as well as innovative ways. Seeking to have sustained influence on risk reduction behaviors and STI incidence, one intervention used telephone-based counseling over a 3-year period [15]; remaining in contact with participants over this period of time was likely facilitated by high rates of cellphone use among its adolescent participants. However, scale-up of phone-based counseling is likely to be labor intensive and pose sustainability challenges. Future studies could explore using automated voice response technology to help overcome these issues. To expand the reach of a face-to-face evidence-based intervention to women in rural settings, another intervention used video-groups [16]; however, this approach still required participants to travel to community sites to use the videophones, thereby decreasing the intervention's potential reach. Perhaps, the most novel interventions we found were those using mobile handheld devices which

likely made it convenient for participants to view the videos [19, 20]. However, feasibility of providing MP4 players and smartphones once implemented in the real world remains questionable.

Texting, which seems to be commonly used among adolescent or adult women with or at risk for HIV, was not utilized in any published interventions specifically focused on adolescent or adult women. Cellphones for text messaging have been commonly leveraged in HIV-related behavioral interventions in sub-Saharan Africa [21] as well as those targeting adolescents in the U.S. [9]. The portability of cellphones allows participants to be reached wherever they are and would allow individuals to use their own devices.

Computer-based technology

We found that interventions exclusively or primarily delivered via computers tended to be adaptations of face-to-face evidence-based interventions and, similar to HR-VG, reflect an attempt to address challenges posed by their face-to-face counterparts. The majority of the studies focused on primary HIV prevention among adolescent or adult women. Those that were adapted tended to be shorter than their face-to-face equivalents and often used a multimedia approach including videos and interactive games.

Exclusively computer-delivered interventions

An RCT examined the preliminary efficacy of Multimedia SiHLE, a computer-delivered adaptation of Sistas Information, Healing, Living, and Empowerment (SiHLE), among African American female adolescents [23]. SiHLE, a four 4-hour group-based intervention focused on HIV/STI risk reduction skills training, was adapted into two 1-hour individual computer sessions [24]. The computer sessions involved narration by health educators, videos simulating group discussion, role playing exercises and interactive activities such as games and quizzes [23]. Among both intervention and control participants, condom-protected sex acts and condom self-efficacy increased significantly. However, no between-group comparisons of these measures were provided.

In an RCT, Klein et al. tested the efficacy of multimedia WiLLOW among women living with HIV [25]. Multimedia WiLLOW was another computer-based adaptation of an existing face-to-face prevention intervention. Traditional WiLLOW focused on instilling self-pride and developing stress management and risk reduction skills to help maintain healthy relationships [26]. Its multimedia version involved the same content, but delivered via a computer using visual and audio presentations, interactive exercises, and video recordings that simulate group discussions [25]. For those with limited digital literacy, a brief tutorial provided instruction regarding how to use the intervention computer program. Compared with control participants, intervention participants reported a significantly higher proportion of condom-protected sex acts and were more likely to report 100% condom use.

Adult women with mild to moderate intellectual disability were the focus of another computer-based HIV prevention intervention. Using a pre-post design, Delaine evaluated the feasibility of a computer-based intervention to improve HIV/AIDS knowledge, condom application skills, HIV avoidance strategies, and intention to use condoms among adult

women with mild to moderate intellectual disability [27]. The intervention, delivered via laptop, included animation, video vignettes, and interactive quizzes. Compared to before the intervention, after completing the intervention, participants experienced significant improvements in almost all knowledge and skills domains.

Mixed/hybrid computer-delivered interventions

SISTA was adapted into SAHARA (Sistas Accessing Health Resources at a Click), then tested using an RCT to examine SAHARA's efficacy in reducing HIV sexual risk behaviors among young African American women [28–29]. SAHARA included two 1-hour computer sessions which involved video of group discussions and interactive modules including games and quizzes, followed immediately by a 20-minute face-to-face wrap-up session with a health educator [28–29]. Control arm participants were randomized to an in-person 1-hour group session about general health and HIV prevention. All sessions took place at a local Planned Parenthood. Compared with control participants, intervention participants reported a significantly higher proportion of condom-protected sex acts and more consistent condom use. The intervention will be available via USB flash drive and Internet download for widespread use.

Another study adapted a face-to-face intervention (traditional Project WORTH) into a hybrid intervention (multimedia Project WORTH) and then tested its efficacy in an RCT. Multimedia Project WORTH is a hybrid intervention to decrease HIV sexual risk behaviors and HIV/STI incidence among drug-involved women under correctional supervision [30]. The traditional and multimedia Project WORTH interventions involved four weekly group sessions about HIV prevention that focused on psychoeducation and building risk reduction skills. However, multimedia Project WORTH participants used individual laptop computers at group sessions led by a facilitator. Multimedia Project WORTH's intervention included individual self-paced activities (e.g., videos and computerized games) as well as group-based activities guided by the facilitator who had a more limited role than in traditional Project WORTH [30]. A third (control) arm involved a group-based wellness promotion intervention. Compared with control participants, women assigned to traditional or multimedia Project WORTH had significant reductions in high-risk sex acts; however, there was no difference between the two Project WORTH conditions and the control arm with respect to STI/HIV incidence.

Brown et al. conducted an RCT to examine the efficacy of a computer-based stress management intervention for HIV-positive women [31]. The role of stress in immune function and medication adherence is an important one, particularly, in light of the unique challenges that women with HIV face [3]. As stress management interventions tend to be group-based and require multiple visits, the authors adapted a coping intervention for HIV-positive MSM into a single 90-minute computer-delivered stress management training [32]. Participants also received a brief motivation session with a counselor as well as workbook and CD. Compared with control participants, intervention participants had significantly greater stress management knowledge, but there were no significant differences in coping self-efficacy or perceived stress.

In summary, most exclusively or hybrid computer-delivered interventions were computer-based adaptations of already existing face-to-face prevention interventions. All studies that we identified required participants to travel to a clinical or community site to engage with the technology. Additionally, hybrid or mixed modality interventions in this review required personnel to also deliver intervention content. As such, computer-delivered interventions failed to fully realize the potential that technology-based interventions can offer, including expanding reach and reducing personnel costs, training, and time. Overall, most interventions showed significant improvements in outcomes compared with the control condition; however, for the most part, adapted interventions were not compared with the original face-to-face counterparts.

Internet-delivered interventions

To our knowledge, SiHLEWeb.com is the only published intervention explicitly focused on adolescent or adult women with or at-risk for HIV which utilized the Internet as its primary intervention delivery platform [33–34]. In a pre-post feasibility study, Danielson et al. evaluated changes in HIV/STI knowledge and sexual behavior among female adolescents [34]. SiHLEWeb.com included four 1-hour modules which simulated group participation using an interactive design which allowed for real-time feedback based on participants' responses. Participants were recruited from the community and given the intervention website address to access at a time convenient for them. About two-thirds of the 41 participants completed all modules. Among completers, significant improvements were observed in HIV/STI knowledge and condom self-efficacy. Common reasons for non-completion included forgetting to or not knowing how to access the website. Only one participant reported no access to the Internet as a reason for non-completion and none reported difficulty using the site. This intervention substantially differed from other interventions we reviewed because it took full advantage of the technology's features, which included accessing the Internet on any device in any location.

Other technology-delivered intervention studies

In examining other technology-delivered interventions for women with HIV, a recent systematic review of mobile health (mHealth) technology interventions for HIV self-management in African American women identified no published studies that focused explicitly on African American women or in which African American women constituted the majority of the study population [35]. In our search, we did not find any mHealth interventions for HIV self-management which focused on women in general. Another recent systematic review of technology-delivered interventions to promote engagement in the HIV focused specifically on smartphone, Internet and Web 2.0 technology [10]. These interventions were characterized by peer-to-peer interaction and collaboration using social media platforms. The review found no published interventions specifically designed to improve women's engagement along the HIV care continuum. One ongoing study is testing a group clinical visit approach using both in-person and online groups to improve adherence among HIV-positive women (Oni J. Blackstock, personal communication). Formative data from this study suggest a high level of interest in online interventions; however, trust and confidentiality remain concerns about participating in online group-based interventions [36].

Methodological limitations of the literature

We found several methodological limitations to the studies included in this review. Many of the studies had relative small sample sizes as they sought to examine feasibility or preliminary efficacy. As such, they were not powered to identify differences in biological outcomes (e.g., HIV/STI incidence) between intervention and control conditions. Therefore, primary outcomes for most studies were cognitive (e.g., HIV/STI knowledge), psychological (e.g., condom self-efficacy) and behavioral (e.g., self-reported condom use). With regards to recruitment, unlike technology-delivered interventions focused on other populations such as MSM, studies in this review did not leverage the Internet or other platform such as social media to recruit potential participants. Instead, participants were recruited from brick-and-mortar clinical or community sites, except for one study which, in part, used recruitment ads on Craigslist [23]. In most cases, adapted technology-delivered interventions were not directly compared to their traditional face-to-face versions to ensure they were at least as good as the traditional version. Lastly, for most studies, post-intervention follow-up was typically 3–6 months which limits the ability to examine the durability of an intervention's impact.

Future directions

Given the limited breadth of technologies leveraged in HIV prevention interventions for adolescent and adult women, we provide the following suggestions for future directions

- Delivery platforms:
 - Employ a wider breadth of technology delivery, particularly mobile devices, the Internet, and Web 2.0.
 - ◆ Mobile technologies enable participants to be reached whenever and wherever they are. Given high rates of cell phone ownership, prevention interventions that utilize text messaging would seem quite acceptable and feasible for adolescent and adult women with or at-risk for HIV. For adolescents, in particular, using mobile applications (e.g., apps) on smartphones to deliver tailored intervention content represents another promising approach. Mobile devices could also support innovative technologies such as ecologic momentary assessments (EMA) which would allow for real-time feedback [37]. A recent study found cellphone diaries (a type of EMA) to measure HIV risk behaviors among female sex workers to be both feasible and acceptable [38]. Currently, a mobile app to decrease HIV risk behaviors among adolescent and young adult African American women and Latinas is being pilot tested (Sonia Gonzalez, personal communication) but no other similar studies targeting these groups appear to be in the pipeline.
 - ◆ Internet-based technology has been woefully underutilized and should be exploited given the high rates of Internet use especially among adolescents. Web-based interventions have the ability to host diverse

approaches including those using interactive videos or games. For adult women with or at-risk for HIV, the feasibility of incorporating instruction in web-based interventions as well as providing participants with access to the Internet and/or to Internet-enabled devices should be further evaluated.

- ◆ Web 2.0 (e.g., Facebook) is being utilized in prevention interventions for adolescents and for MSM [39–41]. For example, an ongoing study targeting young MSM uses Facebook and other social media sites to disseminate messages about HIV pre-exposure prophylaxis through online social networks (PrEP) (Viraj V. Patel, personal communication). Moreover, existing social media platforms like Instagram and Twitter, which appear to be popular among young people and African Americans, may be leveraged to recruit or deliver interventions to adolescents and young adult women with or at-risk for HIV.
 - ◆ Online group format, which may be supported by mobile apps, the Internet, or Web 2.0, warrants further study, particularly, among adult women. Currently, recent studies examined a mobile app (Tabor E. Flickinger, personal communication) as well as peer-to-peer support webpage [41] to harness social support to improve HIV outcomes. However, to our knowledge, no published studies specifically focus on adolescent or adult women. A feasibility study is under way to develop and test a hybrid in-person and virtual group intervention for HIV-positive women with suboptimal antiretroviral adherence (Oni J. Blackstock, personal communication).
- Targeted populations: While there is a relative dearth of technology-delivered prevention interventions targeting adolescent and adult women, studies focused on secondary prevention, particularly, among adolescent women, would potentially help to improve HIV outcomes among this target population and decrease HIV transmission.
 - Prevention focus: For primary prevention, technology-delivered interventions could examine the ability of technology to increase PrEP knowledge and uptake among adolescent and adult women at high HIV risk. For treatment as prevention, technology-based interventions could help to improve adolescent and adult women's engagement in the HIV care continuum.
 - Methods: Like studies in other populations, future research should consider recruitment from online venues such as social media and dating websites. Larger technology-delivered intervention studies with sufficient power to assess biological outcomes are also needed. Additionally, if adapting existing face-to-face interventions to a technology-delivered version, studies should compare the traditional version with the updated technology delivered version to ensure it is as good as the original. However, we emphasize the need to move beyond just

adapting existing face-to-face interventions as these adaptations do not fully utilize the unique aspects that technology has to offer.

Conclusions

Overall, technology-based intervention studies focusing on adolescent and adult women with or at-risk for HIV fail to utilize and exploit the full range and capabilities of available digital media technologies. Because of this shortcoming, the reach and potential impact of existing interventions are limited. Most technology-delivered HIV prevention interventions targeting adolescent or adult women focused on primary prevention and/or were computer-based adaptations of existing face-to-face interventions. There was a relative lack of studies for secondary prevention of adult women and none explicitly focused on HIV-positive adolescent women, a group with likely high levels of technology use and in high need of social support. As such, using technology to deliver primary and secondary HIV prevention interventions for adolescent and adult women remains a fertile and relatively untapped area of HIV prevention research. Future interventions need to capitalize on a wider breadth of digital media technology to harness its full potential to reach and engage adolescent and adult women with or at risk for HIV and address their unique needs to improve health outcomes.

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Table 1
 Characteristics of studies on technology-delivered HIV prevention interventions in adolescent and adult women in the United States (N=11)

Author, publication year	Population	Study design, sample size	Type of intervention	Intervention description	Results	Prevention focus
Phone- and mobile-based technology						
DiClemente et al., 2014	14–18 y.o. African American (AA) adolescent females	RCT, N=701	Brief telephone- based counseling	Intervention: Prevention maintenance intervention (PMI) which involved brief, tailored telephone counseling every 8 weeks for 36 months Control: Telephone counseling involving general health promotion with same frequency and dose as the intervention arm	Intervention arm less likely to have incident chlamydial infection, reported higher proportion of condom-protected sex acts and fewer episodes of sex while high on drugs/ alcohol compared with control arm.	Primary
Marhefka et al., 2014	18+ y.o. women with HIV	RCT, N=71	Video-group using videophones	Healthy Relationships Video-Group: a video-group adaptation of the evidence-based Healthy Relationships which involved six 2-hour sessions via videophones led by two facilitators located a different site Control: wait-list	At 6-month follow-up, no significant difference between arms in engaging in any vs. no unprotected protected sex. Among those who engaged in any unprotected sex in the previous 3 months, intervention arm had 6.89 fewer unprotected sex acts than the control arm.	Secondary
Barroso et al., 2014	18+ y.o. women with HIV	RCT, N=100	Video on MP4 player	Intervention: MP4 player with 45-minute video of vignettes about HIV+ women discussing how stigma has affected their lives and the ways in which they have coped with stigma. Participants were instructed to watch at least weekly for weeks 1–4 and as desired weeks 5–12. Control: MP4 player without no content loaded	At 90 days post-randomization, compared with the control arm, significant decreases in internalized stigma and improvements in self-esteem and coping self-efficacy were observed in the intervention arm.	Secondary
Jones et al., 2013	18–29 y.o. women	RCT, N=295	Videos streamed via smartphones	Love, sex, and Choices: 12-week soap opera video series delivered to study-provided smartphones; 15-to-20 minute episodes streamed weekly with plots that deal with characters in high risk relationship dilemmas demonstrating the process of changing risk behaviors	At 6 months post-intervention, video group had a significant decrease in condomless sex acts in past 3 months, from 21.33 at baseline to 5.92. However, no significant difference observed	Primary

Author, publication year	Population	Study design, sample size	Type of intervention	Intervention description	Results	Prevention focus
Computer-based technology: Exclusively computer-delivered interventions						
Klein et al., 2011	14–18 y.o. AA adolescent females	RCT, N=178	Computer-based	Multimedia SHILE: Two 1-hour computer-based sessions adapted from an evidence-based intervention. Intervention consisted of videos that simulate small group discussions as well as interactive activities such as role playing exercises games and quizzes. Control: 65-minute computer-delivered video on diet and nutrition	Pre-post change in mean proportion of condom protected vaginal intercourse acts increased from 51% at baseline to 71% 3-month post-intervention (p=0.05) in intervention arm. No significant change was observed in control arm. No comparison of arms provided.	Primary
Klein et al., 2013	18–50 y.o. AA women with HIV	RCT, N=187	Computer-based	Multimedia WILLOW: a computer-delivered adaptation of an existing evidence-based intervention. Two 1-hour modules included visual and audio presentations, videos of group discussions from traditional WILLOW, and a tutorial for those with limited computer literacy. Control: Review of HIV educational brochures for persons living with HIV	Intervention arm reported higher proportion of condom protected sex acts in past 30 days and were more likely to report consistent condom use and have lower number of unprotected sex acts in the past 30 days compared with the control arm.	Secondary
Delaine, 2014	24–59 y.o. women, 56% White	Pre-post, N=25	Computer-based	Intervention: HIV/AIDS knowledge, HIV avoidance strategies, and condom application and negotiation skills delivered via laptop using animation, video vignettes, and interactive quizzes.	Significant improvements were noted in most knowledge and skills domains.	Primary
Computer-based technology: Mixed/hybrid computer-delivered interventions						
Card et al., 2011 Wingood et al., 2011	18–29 y.o. AA women	RCT, N=135	Computer-based and face-to-face	SAHARA: Two 1-hour computer-based sessions adapted from the evidence-based SISTA. Intervention comprised of video clips of group discussions and modeling of self-protective behaviors, interactive modules included simulated role-playing and games and quizzes. Computer sessions followed by a brief 20-minute group wrap-up. Control: 1-hour group session consisting of general health information, brief video on HIV	At 3-month post-intervention, intervention arm had greater HIV/STI prevention knowledge, condom self-efficacy, and a high percentage reported of condom protected sex acts (85.3% vs. 52.8%, p=0.03), and more consistent condom use (aOR=5.9, 95%	Primary

Author, publication year	Population	Study design, sample size	Type of intervention	Intervention description	Results	Prevention focus
El-Bassel et al., 2014	18+ y.o. and with criminal justice system involvement	RCT, N=306	Computer-based and face-to-face	<p>Traditional WORTH: Comprised of four 1.5–2 hour sessions focused on HIV prevention psychoeducation and skills building occurring once a week for four weeks led by a facilitator</p> <p>Multimedia WORTH: Same schedule as the traditional version except content delivered in a group session via laptop computers with facilitator in a more limited role. Computer content included interactive computer games, video vignette, and a computerized and web-connected tool to identify needed services.</p> <p>Control: Attention-control wellness promotion intervention delivered in group setting</p>	<p>Over the 12-month follow-up period, both WORTH conditions were significantly more likely to have a higher proportion of condom protected sex acts and consistent condom use as compared with control. No significant difference noted in HIV/STI incidence between the two WORTH conditions and control condition.</p>	Primary/ Secondary
Brown et al., 2011	18+ years women with HIV	RCT, N=60	Computer-based	<p>Intervention: one 90-minute computer delivered-session adapted from an evidence-based stress management intervention for men who have sex with men. Modules included an overview of stress and associated symptoms, how to evaluate stressful situations, coping strategies, and relaxation training. Participants received a brief motivation session as well as a workbook and CD.</p> <p>Control: Wait list control</p>	Stress management knowledge increased significantly in the intervention arm as compared with the control arm. However, no differences between arms were observed in other measures.	Secondary
Internet-based technology						
Danielson et al, 2013	12–19 y.o. females,	Pre-post, N=41	Website	<p>SiHLEWeb.com: Four 1-hour modules using video-based design to simulate group discussion and enable interactive activities with real-time feedback. Also included video peers, health educations, as well as a near peer.</p>	<p>63% of sample completed website. Among completers, significant improvements were noted in condom use-self-efficacy at 3-months postintervention. No changes were observed in partner communication, ethnic pride, and self-esteem</p>	Primary