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eHealth interventions for HIV prevention

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Abstract

The rapidly changing media landscape and proliferation of new technologies creates vast new opportunities for HIV prevention. The fast growth of the relatively new eHealth field is a testament to the excitement and promise of these new technologies. eHealth interventions in HIV prevention tested to date include computer- and Internet-based interventions; chat room interventions; text messaging interventions; and social media. The current article provides a brief review of these types of interventions in HIV prevention, including their unique advantages and evidence of efficacy. Implications for future research in the eHealth HIV prevention field are discussed.

Keywords

eHealth; computer; Internet; condom use; HIV prevention

Introduction

The rapidly changing media landscape and proliferation of new media technologies creates vast opportunities for health promotion and disease prevention. Seventy-nine percent of American adults now regularly use the Internet, and 66% of American adults have a broadband Internet connection at home. The gap in home broadband access among varying racial groups is closing, with 56% of African-Americans now having such access compared to 67% of whites (Pew Internet & American Life Project, 2010a). Health information is one of the most popular topics to search for online, with 80% of Internet users seeking such information. The most common health-related search topic involves looking for information about a specific disease or medical problem (Pew Internet & American Life Project, 2011a).

In addition, the use of social networking websites such as Facebook, MySpace, and Twitter is increasing among the American population. The number of individuals using social networking sites doubled between 2008 and 2011. Fifty-nine percent of adult Internet users now use such social networking sites (Pew Internet & American Life Project, 2011b), while nearly three-fourths of adolescents and young adults use such websites (Pew Internet & American Life Project, 2010b). A majority of young people now interact with social media every day or nearly every day (Whiteley et al., 2011), with Facebook being the most popular

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social networking site among both adolescents (Pew Internet & American Life Project, 2010b) and adults (Pew Internet & American Life Project, 2011b).

Moreover, three-fourths of adolescents (aged 12–17) have cell phones, with most first getting such phones at age 12 or 13. Eighty-eight percent of adolescent cell phone users use text messaging, up from 51% in 2006 (a 42% increase). Half of teens using text-messaging send 50 or more text messages per day, and one in three send more than 100 text messages per day (Pew Internet & American Life Project, 2010c). African-Americans are slightly more likely to use text messaging than whites, and they are also more likely than whites to go online via their cell phone. Interestingly, while use of texting has been increasing over time, use of other cell phone functions, such as voice calling, email, and instant messaging, has remained stable during that same period of time (Pew Internet & American Life Project, 2010c).

While these data prompt concern in some quarters, they also represent the reality of the twenty-first century. The health communication community has responded to this reality by studying how such technologies can be used for health promotion and disease prevention. The result – the eHealth field – focuses on “the use of emerging information and communication technology, especially the Internet, to improve or enable health and health care” (Eng, 2001, p. 1). Although this field is relatively new, it is developing at a rapid pace, and the evidence base of eHealth applications and interventions is growing quickly (Bull, 2011; Kreps & Neuhauser, 2010; Noar & Harrington, in press).

The purpose of the current article is to briefly review and discuss eHealth interventions in HIV prevention. The field has grown rapidly in a multitude of directions, and here we focus on interventions designed for the primary prevention of HIV infection through behavioral changes, including sexual risk behavior and HIV testing. We examine what applications/interventions exist; their unique advantages; how they have been applied and tested to date; and finally, evidence of their efficacy (see Table 1).

Computer and Internet-based interventions

There has long been interest in using computer technology for sexual health and STI/HIV prevention (Conlon, 1997; Paperny, 1997). Computer technology has numerous advantages, including interactivity and multimedia features, the ability to deliver individualized content, and automated delivery of interventions, which can reduce program costs. The Internet brings with it a number of key features, including the potential for broad reach. Given that computers have been around longer than the Internet or cell phones, some of the earliest eHealth applications in HIV prevention were CD-ROM and local computer-based programs. These studies in many ways were “proof of concept” studies testing the ability of interactive, computer-based programs to improve beliefs and behaviors related to sexually transmitted infections (STIs), including HIV/AIDS. Such programs showed some success, demonstrating positive changes in safer sex and HIV/STI-related knowledge and beliefs (e.g., attitudes, self-efficacy). For example, programs have increased knowledge and beliefs relative to lecture-based instruction (Evans, Edmundson-Drane, & Harris, 2000), counseling interventions (Marsch & Bickel, 2004), attention control (Noell, Ary, & Duncan, 1997), and

no intervention (Di Noia, Schinke, Pena, & Schwinn, 2004) conditions. Some studies also have provided evidence that such programs are capable of reducing risky sexual behaviors (Downs et al., 2004; Kiene & Barta, 2006; Lightfoot, Comulada, & Stover, 2007; Marsch & Bickel, 2004; Read et al., 2006). Most recently, studies have demonstrated reductions in STI outcomes in response to interactive, computer-based programs (Downs et al., 2004; Grimley & Hook, 2009).

As the Internet developed, researchers began testing programs using this medium. Several studies have demonstrated the efficacy of web-based programs in the promotion of HIV/AIDS knowledge (Lockyer, Patterson, & Harper, 1999; Lou, Zhao, Gao, & Shah, 2006; Tian et al., 2007). In addition, a number of studies have tested the ability of interactive, web-delivered programs to increase safer sexual behaviors among men who have sex with men (MSM). While these studies have met with some success (Bowen, Williams, Daniel, & Clayton, 2008; Davidovich, de Wit, & Stroebe, 2006; Rosser et al., 2010), some have had limited effects (Bull, Pratte, Whitesell, Rietmeijer, & McFarlane, 2009) and/or retention problems in the context of online randomized trials (Bull, Lloyd, Rietmeijer, & McFarlane, 2004).

Two meta-analyses of computer- and Internet-based interventions were recently undertaken to provide a quantitative synthesis of this literature (Noar, Black, & Pierce, 2009; Noar, Pierce, & Black, 2010). Results demonstrated that such interventions have been successful in significantly improving safer sex knowledge, attitudes, self-efficacy, and other theoretical mediators of safer sex. In addition, such interventions have been successful at increasing safer sexual behaviors, most notably condom use. A Cochrane review found similar effects of such interventions (Bailey et al., 2010). Perhaps most interesting, the effect sizes found in the Noar et al. meta-analyses were not unlike those found in human-delivered HIV prevention interventions. Moreover, the evidence suggested that interventions that were more carefully targeted (e.g., on gender) and tailored (e.g., on psychosocial characteristics) were more efficacious than those interventions not applying targeting or tailoring (Noar et al., 2009, 2010).

Chat room interventions

As the Internet was becoming more widely used, researchers began documenting the fact that many MSM were meeting risky sexual partners online (Bull, McFarlane, Lloyd, & Rietmeijer, 2004; Bull, McFarlane, & Rietmeijer, 2001). This realization paved the way for interventions in chat rooms where MSM sometimes meet such risky sexual partners. Such interventions are *not* automated like the Internet-based interventions discussed above but rather involve a human counselor who joins the chat and provides safer sex and HIV testing information and advice. Such interventions have numerous advantages, including reaching high-risk MSM where they may naturally gather, utilizing a live human interventionist who can respond dynamically in the context of conversations, and retaining anonymity of both interventionist and participants. A variation on chat room interventions is instant messaging interventions where men are recruited from places like chat rooms for online counseling via the web (Moskowitz, Melton, & Owczarzak, 2009).

Rhodes and colleagues have developed and piloted an intervention designed to promote HIV testing among MSM in chat rooms (Rhodes et al., 2010, 2011). The *CyBER/testing* intervention uses an interventionist who is available in chat rooms. The interventionist, who has undergone extensive training, enters the chat room and posts every 30 minutes about HIV testing and his availability to provide additional information. The interventionist does not directly message other chatters unless they instant-message him first.

In a pilot evaluation of *CyBER/testing* that applied a single group, pretest–posttest design, Rhodes et al. (2011) found that the intervention increased self-reported HIV testing from 44.5% at pretest to 59.4% at posttest. This difference was found to be even greater for chatters who reported having sex with both men and women; for this group, 18% reported having an HIV test at pretest and 55% reported having such a test at posttest. This study shows that chat room-based interventions can reach populations that may be difficult to reach in traditional venues (Rhodes et al., 2011). Reaching MSM remains a critical priority to this day, and additional work (including more rigorous evaluation) is needed on chat room and other online interventions for reaching MSM with prevention messages (Rosser et al., 2009, 2011).

Text messaging

More recently, text messaging has been applied as an HIV/STI prevention strategy. Text messaging has several advantages, including the ability to reach individuals where they are (literally), unique features such as location-based services, and the convenience of having messages delivered directly to participants. Text messaging can also be a good way to reach people with topics that traditionally have stigma associated with them, such as sexual health (Lefebvre, 2009).

A number of sexual health text message programs currently exist. To date, such programs have been well received by target populations who indicate that mobile technologies provide a valuable way to share information about sexual health issues (Gold, Lim, Hellard, Hocking, & Keogh, 2010; Wright, Fortune, Juzang, & Bull, 2011). Some services allow for personalized interaction with health education professionals (Phillips, 2010), while others allow users to access a variety of prompts related to specific topics. SexINFO, for example, allows youth to opt into the service and then receive a menu with codes that instruct them to text certain codes if they want information about a topic (Levine, 2011; Levine, McCright, Dobkin, Woodruff, & Klausner, 2008). SexINFO provides not only facts about sexual health and relationships, but also referrals to clinical and social services (Levine, 2011). In a review of Sex-INFO, Levine et al. (2008) found that the most frequently accessed prompt was “if ur condom broke” followed by “to find out about STDs,” “if u think ur pregnant,” and “to find out about HIV.”

Another way text messages are used for sexual health promotion and HIV prevention involves the sending of persuasive messages via text. Gold and colleagues found that adolescents in Australia had increased sexual health knowledge and fewer sexual partners after receiving sexual health text messages, as compared to a group that received sun safety messages (Gold et al., 2011). In another intervention, researchers sent three text messages a

week for 12 weeks that provided HIV prevention messaging to 16–20-year-old sexually active black men in Philadelphia (Juzang, Fortune, Black, Wright, & Bull, 2011). The messages focused on increasing condom use and reducing one’s numbers of sexual partners. Results indicated that message recipients showed increased monogamy compared to participants in the control group. While message recipients also exhibited greater sexual health awareness compared to baseline, awareness levels did not differ significantly from the control group. These findings, together with the ubiquitous nature of cell phones, youths’ propensity to text, and possible greater sexual risk-taking by heavy cell phone users (Whiteley et al., 2011), demonstrate that text messaging services can and should play a role in HIV prevention. However, additional research needs to be conducted to better understand message efficacy (e.g., content, timing, targeting/tailoring) in texting as well as to formally (and rigorously) evaluate various text messaging programs.

Social media

As social media and so-called “Web 2.0” represents one of the newest developments online (Thackeray, Neiger, Hanson, & McKenzie, 2008), so too is this the newest frontier in HIV prevention. Social media are a compelling intervention channel given the fact that youth are increasingly spending large amounts of time on social media websites (Pew Internet & American Life Project, 2010b; Whiteley et al., 2011). In addition, social media websites take advantage of social networks, and messages delivered in this context will have an increased chance of proliferating throughout one’s social network (aka, “going viral”).

Social media sites such as Facebook (launched in 2004) and Twitter (launched in 2006) are relatively new. Thus, to date, little work has formally evaluated HIV prevention strategies using social media. One major study that has recently been conducted in this area is the Just/Us study (Bull et al., 2011). The major goal of this study was to engage youth of color in sexual health education via Facebook. In particular, the study sought to evaluate whether an HIV prevention intervention delivered on Facebook can increase safer sex knowledge, attitudes, and behaviors relative to a news and current events control condition (also a Facebook page). Participants were randomized to receive either HIV prevention education or the news/current events page. The intervention included HIV risk information, blogs where participants could post messages, videos to view online, and other topical information on safer sex and HIV. More than 1500 (primarily African American and Latino) young adults were recruited into the study using various methods, and they were also asked to help recruit additional study participants. The original participant, or “seed,” was randomized to a group, and all other participants referred by that “seed” were placed in the same study group (to avoid contamination). All participants filled out a baseline assessment as well as two follow-up assessments – at two- and six-month intervals.

Using social network analysis methods, results have provided evidence of short-term small to moderate effects on condom use at last sex and proportion of protected sex acts over the two month recall period. At the six month assessment, however, the effects decayed (Bull, Levine, & Santelli, 2011). This innovative study represents an important step forward in the application of social media to HIV prevention. Additional work in this area is clearly warranted.

Future directions for research

The eHealth HIV prevention field is growing rapidly. Many more interventions have been developed and evaluated than was the case just a few short years ago (Bull, 2008; Noar, 2009; Ybarra & Bull, 2007). Still, we need additional studies that apply and rigorously evaluate the most fruitful eHealth applications with high-risk and HIV-positive populations. Indeed, given the increased focus on HIV-positive populations in the field, work applying eHealth applications to positive populations is beginning to appear (Chen et al., 2008; Lynne et al., 2010). This work is critical as the field shifts much of its effort to identifying and treating HIV-positive populations as a key prevention strategy (AIDS Alert, 2010). In addition, although there have been significant recent biomedical advances in HIV prevention (Mayer, Skeer, & Mimiaga, 2010), such advances present key behavioral issues (de Wit, Aggleton, Myers, & Crewe, 2011), some of which can be addressed through eHealth applications [e.g., medication adherence; (Hardy et al., 2011)].

Finally, while the Internet is filled with HIV/AIDS information and safer sex websites, the functionality and quality of such sites varies greatly (Keller, Labelle, Karimi, & Gupta, 2004; Noar, Clark, Cole, & Lustria, 2006). Key to eHealth interventions having a real impact will be bringing evidence-based interventions to the populations most affected by and infected with HIV/AIDS, and several activities must take place to realize this goal. First, to date many eHealth HIV prevention interventions were “proof of concept” studies or interventions that were not designed for dissemination. Some of these interventions could perhaps be “retro-fitted” for dissemination, a process that involves several important steps (see Vinson et al., 2011). Also, since we are now moving past the proof of concept stage in many eHealth domains, future interventions should be designed with dissemination considerations in mind, including feasibility to implement in the real world, gaining community buy-in early on, and collecting implementation-oriented data during research testing (see Eke, Neumann, Wilkes, & Jones, 2006; Vinson et al., 2011). Second, work is needed to understand how to best package and disseminate eHealth interventions. While such research has been conducted for “offline” behavioral interventions in the context of the Diffusion of Effective Behavioral Interventions (DEBI) project (Collins, Harshbarger, Sawyer, & Hamdallah, 2006), work is needed to adapt this model for eHealth interventions. Third and finally, a broader agenda of implementation and dissemination (I&D) research on eHealth interventions in HIV prevention is needed (Noar, 2011). I&D research is defined as the systematic study of processes and factors that are associated with the spread, uptake, and utilization of an intervention by the target audience and the integration of the intervention within the target setting (Rabin, Brownson, Haire-Joshu, Kreuter, & Weaver, 2008). We are just beginning to see this type of research emerge in the eHealth field, and much more work is needed, both in HIV prevention and in a number of health-related fields (Rabin & Glasgow, in press). For example, we need to understand not only how to functionally disseminate such interventions into real world settings, but also how active engagement and use of such interventions by high-risk and HIV-positive populations can be achieved. We also need a much better grasp on intervention maintenance, both at the individual and institutional levels. Ultimately, our goal should be to move a wealth of evidence-based

eHealth interventions out of the laboratory and into high-risk and HIV-positive populations' lives where they can have a positive impact.

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Table 1

Overview of several types of eHealth interventions in HIV prevention.

Type	Description	Key advantages	Applications	Effects
Computer and Internet-based interventions	Interactive programs designed to impact HIV-related risk behaviors. These include group targeted, individually tailored, and virtual decision-making interventions	Interactivity and multimedia; individualized content; automated intervention	Numerous applications to heterosexuals and MSM exist	Two meta-analyses and a Cochrane review of this literature have shown significant effects of these programs on mediators of safer sex as well as safer sexual behaviors (Bailey et al., 2010; Noar et al., 2009, 2010)
Chat room interventions	Interventions designed to promote safer sex in chat rooms where MSM often meet risky partners	Reach high-risk MSM where they are; live human interventionist can respond dynamically to queries and be an active part of conversations; anonymity of interventionist and participants	Applications to date focus on MSM	In a single group, pretest–posttest design, Rhodes et al. (2011) found significant increases in self-reported HIV testing in response to a chat room intervention
Text messaging	Programs and services designed to serve a variety of purposes with regard to safer sex and HIV/STI testing, including counseling via text, locating testing sites and condoms, and safer sex promotion	Reach individuals on the go with messages sent at opportune times; unique features such as location-based services; convenience for participants	Applications are growing, including those that focus on adolescents and young adults. Some services provide info on sexual health and testing services on request (e.g., SEXINFO), while others provide messages on a set schedule	Evidence to date reveals that text messaging may be an effective strategy for safer sex promotion (e.g., Gold et al., 2011; Juzang et al., 2011), but additional evaluation work is needed on this and other intervention outcomes
Social media	Interventions and campaigns that use social media as a primary mode for promoting safer sex and/or HIV/STI testing	Youth increasingly spend time on social media sites; takes advantage of social networks; increases possibility of messages “going viral”	Applications are beginning to appear, such as Bull et al.’s (2011) Facebook intervention study with youth	In the first study of its kind, Bull et al. (2011) reported significant short-term effects of a Facebook intervention with young adults on protected sex. Effects decayed at 6-month follow-up, however.