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The Use of Technology to Advance HIV Prevention for Couples

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Abstract

The majority of HIV prevention studies and programs have targeted individuals or operated at the community level. This has also been the standard approach when incorporating technology (e.g., web-based, smartphones) to help improve HIV prevention efforts. The tides have turned for both approaches: greater attention is now focusing on couples-based HIV prevention and using technology to help improve these efforts for maximizing reach and potential impact. To assess the extent that technology has been used to help advance HIV prevention with couples, a literature review was conducted using four databases and included studies that collected data from 2000 to early 2015. Results from this review suggest technology has primarily been used to help advance HIV prevention with couples as a tool for 1) recruitment and data collection and 2) intervention development. Challenges and limitations of conducting research (e.g., validity of dyadic data) along with future directions for how technology (e.g. mHealth, wearable sensors) can be used to advance HIV prevention with couples are then discussed. Given the growing and near ubiquitous use of the Internet and smartphones, further efforts in the realm of mhealth (e.g., applications or “apps”) and eHealth are needed to develop novel couples-focused HIV preventive interventions.

Keywords

Couples; HIV prevention; Technology; mHealth; eHealth; sensors

Introduction

Since the onset of the HIV epidemic, the majority of HIV prevention research and programmatic efforts have targeted at-risk and affected persons at the individual and community level [1–5]. These approaches are limited because the dyadic context is not taken into consideration even though new infections occur from the engagement in unprotected vaginal or anal sex between two or more individuals (i.e., dyadic interaction). Moreover, recent estimates suggest between one and two thirds of men who have sex with men (MSM) in the US acquire HIV from their primary same-sex relationship partners (i.e., within male couples) [6, 7]. High rates of HIV transmission between primary partners are

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Conflict of Interest

Dr. Mitchell declares that he has no conflict of interest.

Compliance with Ethics Guidelines

Human and Animal Rights and Informed Consent

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influenced by three synergistic behaviors: a higher number of sexual acts with primary partners, a higher likelihood of receptive anal intercourse with primary partners, and lower levels of condom use for anal intercourse with primary partners relative to casual partners [7]. Condomless anal sex (CAS) is regularly practiced within male couples' relationships [8–10], and some partnered men engage in concurrent CAS with both their primary partner and casual partners [8, 9, 11–14]. Partnered, HIV-negative men's testing rates for HIV and other sexually transmitted infections (STIs) are also low and infrequent, despite their engagement in CAS within or outside of a primary relationship [13, 15–17].

Based on these behavioral risk factors, researchers have begun to study how characteristics and dynamics of male couples' relationships may affect their risk for acquisition and transmission of HIV. For example, male couples who communicate constructively, establish and adhere to a sexual agreement, are committed to their relationship, and trust their primary partners engage in less HIV-related risk behaviors, such as CAS with casual MSM partners [8, 10, 12, 18]. However, currently few evidence-based HIV preventive interventions exist for male couples.

Furthermore, high-risk heterosexual contact was, and remains, the primary route of transmission among women and the second largest route of HIV transmission in the United States; among females, 84% of new HIV infections were attributed to heterosexual contact [19]. Further, sexual transmission of HIV among heterosexuals accounts for the vast majority of new infections globally [20]. In response, dyadic preventive approaches have been developed, such as couples HIV testing and counseling (CHCT) [21–23], to address HIV infection rates among heterosexual women and their sexual male partners.

Given the ubiquitous and growing use of technology among adolescents and adults in the United States and globally [24–28], technology has the potential to play a pivotal role in better understanding the behaviors, characteristics and dynamics of couples' relationships, as well as how best to develop novel interventions to prevent the transmission and acquisition of HIV and STIs for this population. In this context, technology refers to browsing websites on a variety of web-enabled electronic devices and applications ("apps") on smartphones and tablets, including geosocial networking apps. Geosocial networking apps allow users to know the approximate location of others who use that particular app. In general, technology in this context includes the use of non-portable and portable electronic devices that are connected to the Internet either through web-based platforms or apps. Further, many websites have corresponding apps to allow their users to connect over multiple electronic devices regardless of their location (e.g., Facebook, Match, Adam4adam).

In this paper, I reviewed the literature on how technology has been used to help advance HIV prevention with couples. Four databases (PsychINFO, Pubmed, MEDLINE, NIH RePORT) were searched for studies that collected data from 2000 to early 2015. The following combinations of terms were used to identify HIV prevention studies with couples that used technology:

- MSM, gay, same-sex, LGBT, heterosexual, couples, dyads, partnered

- HIV prevention
- Technology, web-, Internet, SMS, smartphone, mobile, applications (apps), mHealth, eHealth

Using the search terms above, 257 articles were identified and reviewed. The majority of articles were excluded because the studies either targeted individuals and/or defined technology differently (e.g., in vitro fertilization). Five HIV prevention studies met the inclusion criteria of targeting and/or involving both partners of the dyad and used technology (as defined via search terms). Review of the literature revealed that technology has primarily been used to help advance HIV prevention with couples as a tool for 1) recruitment and data collection and 2) intervention development (see Table 1). Challenges and limitations of conducting research along with potential future directions for using technology to advance HIV prevention with couples are then discussed with examples.

Technology as a Recruitment and Data Collection Tool for Couples

Many adults use the Internet for information seeking and to meet other individuals for sex, relationships and friendships [29, 30]. Taking advantage of the growing use of the Internet for relationship and sex seeking, banner advertisements, targeted advertisements, and/or emails blasts to users of these websites are used to recruit couples for their studies and programs. These advertisements come in two forms: banner advertisements that are displayed on the screen of the users homepage and targeted advertisements that are only sent to users who meet certain, predetermined criteria. While several HIV prevention studies have used this method to recruit and collect data about partnered individuals' relationships [e.g., 31], few have collected data from both members of the couple (i.e., dyadic data) [9, 13, 32]. Collection of dyadic data permits comparison of both members' self-reported scores on measures and behaviors, which is needed for understanding how dynamics impact couples' health and risk for HIV and other STIs [e.g., 33, 34].

Technology for HIV Prevention Intervention Development

Given that few evidence-based HIV preventive interventions exist for couples [refer to 3, 4, 35, 36 for an overview], there is a dire need to help fill this critical gap in public health services. There are a number of HIV preventive intervention development projects underway [37], yet few of these projects are using technology to maximize reach and potential impact for averting future HIV infections. There are currently three in-development couples-based intervention studies that leverage technology. First, Stephenson and colleagues are using an innovative combination of home-based HIV testing and Couples Voluntary Counseling and Testing (CHCT) to investigate the utility of home-based HIV testing combined with an online video operated CHCT session, operated by a remotely located counselor [38]. Second, Mitchell and colleagues are developing an HIV prevention toolkit for at-risk HIV-negative male couples that includes an interactive website and a corresponding app. The goal of this project to guide and assist at-risk HIV-negative male couples, who currently practice unprotected anal sex, form an explicit sexual agreement that integrates interval HIV/STI testing and prevention messaging while uniquely meeting the needs of the couples' relationship [39]. Third, Tan and colleagues are developing a couple-

based mobile health intervention for enhancing HIV care engagement outcomes among Black MSM who are living with HIV and are in a same-sex relationship [40]; however, it is unclear whether this project will involve both members of the couple in the intervention research.

In sum, most coupled-focused HIV preventive interventions are occurring in-person, particularly with heterosexual couples, and the few projects that use technology (e.g., web-based platforms, smartphone apps) target male couples. Thus, additional intervention development projects that incorporate the use of technology are needed to help couples' manage their risk for acquisition and/or transmission of HIV and other STIs.

Challenges and Limitations of Research with Couples

One limitation to recruiting and collecting dyadic data online is verifying the couples' relationship. It is often difficult to validate that both members of the couple are unique individuals and not one person portraying to be both members of the couple. One solution to verify the validity of a couples' relationship remotely is a method, developed by Mitchell (unpublished), in which one member of the couple is first identified as the index person (i.e., recruiter). The index person then recruits the other member of the couple to participate in the study or program by inputting the second members' contact information during the online screening process. The second member then completes the same screening process online. In addition to verifying both couple members' contact information is valid, several measures used in the screening process are then compared as well as their contact information. Decision rules are created ahead of time to assess the validity of the couples' relationship based on the information both members of the couple self-report. Couples who do not meet the threshold of predetermined decision rules are then considered invalid and potentially fraudulent. When recruiting and collecting dyadic data online from couples, other monitoring tips should also be considered and implemented, including the timing of when questionnaires (e.g., screening, study surveys) are started and completed, and whether the same IP address is used by both members of the couple.

Another limitation pertains to how technology has been used to collect data from both members of the couples. Dyadic data collection online has mostly occurred via surveys, however, other data collection options involving digital technology exist to better understand some of the contexts in which couples engage in certain HIV-related behaviors. For example, online diaries and chat rooms – either hosted via an app or website – are two underutilized methods for collecting dyadic data from couples. Some HIV prevention studies have used online diaries with MSM [41–51] and heterosexual women [52, 53]. Other HIV prevention studies have used chat rooms to collect data from individuals [54, 55] as well as a component in a preventive intervention [56, 57]. However, no studies have been published using either of these online data collection tools with couples. Future work is warranted to assess the acceptability and feasibility of using online diaries and chat rooms to collect dyadic data from couples.

Future Directions for Using Technology to Advance HIV Prevention with Couples

Technology can be used in several different domains to help develop and improve HIV prevention efforts for couples. First, researchers and public health practitioners should capitalize on using geosocial networking apps and websites to advertise to facilitate rapid screening and enrollment of partnered individuals and couples into studies and services. Second, apps and web-based programs that include advanced methods to simplify and streamline the linkage and verification of both members of the couples' relationship are needed. Linkage of partners' data not only allows within-dyad data comparisons, but also may help to facilitate syncing features within apps and online HIV prevention programs. For example, if each partner of the couple has the an app on their respective smartphones that was linked, then it would allow one or both of the partners to be notified if the other is in need of HIV-related support, such as adherence to medication or their sexual agreement. However, a challenge is that this type of app would require 'sensors' or a predictive algorithm to detect when a partner may need this type of support, and how best to notify the other member of the dyad to provide this support. Future research studies exploring the possibility of linking apps between both members of the couple, and how best to maximize this feature for facilitating HIV prevention efforts, is warranted and timely.

In other areas of health, such as exercise and activity, wearable devices and sensors are already being used to monitor a person's vital signs and to encourage and maintain positive behavior change [58, 59]. Wearable devices and sensors may include wristbands, watches, and patches that are sewn on or inserted into a piece of clothing or footwear. Analogous to syncing apps between couples' smartphones, syncing wearable devices between partners of the couple, such as web-enabled smart watches, could be used to help inform and notify the individual when she or he may more vulnerable to engaging in HIV-related risk behaviors (e.g., when using substances) and to notify their partner in real time that their support may be needed. This notification of support could be triaged and further extended to prevention practitioners, or other healthcare systems if linked [60]. However, syncing wearable devices and sensors may only appeal to some couples and would require both members of the dyad to agree to participate in this feature. As such, this possibility may only appeal to a certain demographic of couples. To explore the possibility of how wearable devices and sensors could be used to enhance HIV prevention efforts with couples, future projects should include multidisciplinary teams of behavioral scientists, mobile Health (mHealth) experts, and engineers to tackle these issues, as well as, to assess the facilitators and barriers among couples about using this particular type of technology with respect to their sexual health and prevention of HIV and other STIs.

Furthermore, current evidence-based HIV prevention programs that target and involve interacting with individuals face-to-face should be assessed to determine: 1) whether those programs could be adapted to meet the unique needs of couples, 2) how best to involve both partners of the couple, and 3) whether those programs could be implemented online to maximize reach. Similarly, the few current evidence-based HIV prevention programs for

couples (e.g., CONNECT, CHCT) should also be examined to see whether they could be adapted and implemented for a web-based platform (e.g., video-CHCT).

Conclusions

There is room for improvement for using technology to help advance our understanding about couples' relationship dynamics and behaviors with respect to primary and secondary HIV prevention including treatment, as well as, toward development of novel HIV preventive interventions. In particular, future efforts should aim to enhance HIV prevention with this population by using web-enabled devices, apps, wearable devices and sensors, and similar technology to help minimize physical and logistical barriers of learning about new services and prevention options as well as skill-building amongst couples. Furthermore, technology may also be useful for adapting and testing in-person evidence-based interventions to become online interventions. In sum, ample opportunities and advantages exist for improving HIV prevention efforts with couples via mHealth and eHealth initiatives.

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Table 1

How Technology Has Been Used to Advance HIV Prevention with Couples

Lead author [ref]	Years	Population	Technology used	Study design	Main outcome(s)
Mitchell et al. [e.g., 9, 13]	2012, 2014	Male couples in the U.S.	1) Targeted advertisements placed on Facebook; 2) Partner-referral system embedded in SurveyGizmo	Cross-sectional	Descriptive study about couples' sexual behaviors and relationship dynamics
Martinez et al. [32]	2014	Latino male couples	1) Targeted advertisements on social media	N/A	To develop a social media recruitment protocol and to train personnel to recruit for Latino male couples using social media.
Mitchell et al. [38]	2013 – 2016	Concordant HIV- negative male couples in the U.S.	1) Targeted advertisements on Facebook and other social media; 2) Partner-referral system embedded in SurveyGizmo; 3) Interactive website; 4) Smartphone app	Online, longitudinal RCT	1) Formation and adherence to a explicit sexual agreement; 2) Reduce number of CAS acts with casual sex partners; 3) Increase HIV testing behaviors and intentions
Stephenson et al. [37]	2014 – 2018	Concordant HIV- negative and HIV- discordant male couples in the U.S.	1) Targeted advertisements on social media; 2) Informative website; 3) Video-based HIV testing and counseling session	Online, longitudinal RCT	1) Reductions in sexual risk-taking; 2) Formation and adherence to a explicit sexual agreement; 3) Relationship functioning for the management of HIV risk
Tan et al. [39]	2015 – 2018	HIV-positive Black MSM in same-sex relationship	1) mHealth via smartphone app	Unclear	1) Obtain better understanding of couple dynamics involved in HIV care engagement; 2) Development of an mHealth tool that targets couple dynamics important to enhancing HIV care engagement.