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Higher eHealth literacy is associated with HIV risk behaviors among HIV-infected women who use the Internet

Oni J. Blackstock, MD, MHS*,

Assistant Professor of Medicine, Division of General Internal Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, New York, USA

Chinazo O. Cunningham, MD, MS,

Professor of Medicine, Division of General Internal Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, New York, USA

Lorlette J. Haughton, MPH,

Research Study Coordinator, Division of General Internal Medicine, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, New York, USA

Ruby Y. Garner,

Peer Educator, Health People, Bronx, New York, USA

Chris Norwood, and

Executive Director, Health People, Bronx, New York, USA

Keith J. Horvath, PhD

Associate Professor, Division of Epidemiology & Community Health, University of Minnesota School of Public Health, Minneapolis, Minnesota, USA

Keywords

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The proportion of adults in the United States using the Internet has grown exponentially in the past 2 decades, with 87% reporting going online in 2014 (Pew Research Center, 2014). Paralleling this trend has been an increase in individuals seeking health information online, with nearly 60% of U.S. adults having looked online for health information in the past year (Pew Research Center, 2010). The abundance of electronic health (eHealth) technology such as health information Websites, online support groups, and mobile health communication applications may both reflect and be in response to what appears to be a significant need for health-related information, social support, and communication. This need may be greatest

*Corresponding Author: Oni J. Blackstock, oblackst@montefiore.org.

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for persons living with chronic diseases (Pew Research Center, 2010), such as HIV infection (Courtenay-Quirk et al., 2010; Horvath et al., 2012). Persons with chronic medical conditions frequently access the Internet in search of information related to their own health conditions and often use the information they find to inform their health-related decisions (Pew Research Center, 2010). Among people with HIV, health-related Internet use has been associated with antiretroviral adherence, active coping, and social support (Kalichman et al., 2003; Kalichman et al., 2005).

However, successful incorporation of online health information into daily life requires that patients be equipped to navigate health information on the Internet. eHealth literacy is defined as the ability to find, understand, and evaluate health information from electronic sources and apply this information to a specific health problem (Norman & Skinner, 2006), and it is considered an important dimension of seeking online health information (Chesser, Burke, Reyes, & Rohrberg, 2015). Technology may be protective in many situations, but may increase risk in other ways. For example, although men who have sex with men (MSM) in the United States may be more willing to engage in online HIV prevention interventions compared with other at-risk groups (Bull, McFarlane, & King, 2001), many seek sex partners via online and mobile devices, which places them at high risk for HIV and other sexually transmitted infections (Liau, Millett, & Marks, 2006). Although much is known about risks associated with technology-enabled sex seeking, relatively little is known about the association between eHealth literacy and HIV transmission risk behaviors, especially in non-MSM groups, such as HIV-infected women.

HIV-infected women in the United States are disproportionately socioeconomically disadvantaged (Aziz & Smith, 2011), a factor associated with low Internet use and low eHealth literacy (Knapp, Madden, Wang, Sloyer, & Shenkman, 2011; Neter & Brainin, 2012). Our prior research found that, in an urban, community-based cohort of women living with HIV, the proportion of Internet users was lower than that of the general population (Blackstock et al., 2015). However, for those who used the Internet, many were actively engaged in seeking information online for general and health-related purposes and perceived themselves on most dimensions of eHealth literacy to be highly competent. In that same study, Internet use was not associated with HIV transmission risk behaviors, as it had been in other populations. As eHealth technology is increasingly used to address the health needs of persons with or at risk for HIV, the purpose of our exploratory study was to examine the relationship between eHealth literacy and HIV transmission risk behaviors in Internet-using women in a cohort of HIV-infected women. The results may help to inform the development of future eHealth interventions focused on women with HIV as, to date, very few have targeted this priority population (Brown, Vanable, Carey, & Elin, 2011; Klein, Lomonaco, Pavlescak, & Card, 2013; Marhefka et al., 2014).

Methods

Setting and Participants

From February to April 2014, women were recruited at six community-based organizations (CBOs) that provided social and/or clinical services to persons living with HIV in the Bronx, New York. In 2011, HIV prevalence in the Bronx was 1.7%, and as high as 2.4% in some of

the neighborhoods where the study took place (New York City Department of Health and Mental Hygiene, 2012). Potential participants were approached in the waiting areas of the participating CBOs and provided with information about the study by a study coordinator, an HIV-infected woman who also worked as a peer educator. Eligibility criteria included women who were (a) HIV-infected, (b) English-proficient, and (c) at least 18 years old. Study activities were approved by the Albert Einstein College of Medicine Institutional Review Board. Written informed consent was obtained from participants.

Procedures

Interviews occurred in a private room at participating CBOs; interviews lasted from 30 to 45 minutes. The women completed the interview using Audio Computer-Assisted Self-Interview technology to decrease the potential for socially desirable responses and to increase endorsement of sensitive and potentially stigmatizing behaviors (Newman et al., 2002). We collected data from participants about Internet use, eHealth literacy, electronic device ownership, and HIV transmission risk behaviors, as well as socio-demographic and clinical characteristics. At the conclusion of the interview, the women were compensated 25 USD and a round-trip Metrocard (valued at 5 USD) for their time.

Measures

Electronic health literacy—Our independent variable of interest was eHealth literacy, which was measured using the eHealth Literacy Scale (eHEALS), a validated 8-item measure ($\alpha=0.88$; Norman & Skinner, 2006). eHEALS asks respondents, on a 5-point Likert scale, about their knowledge of online health resources including where to locate resources, how to find them, how to use information once obtained, and comfort with assessing the quality of online health information (Norman & Skinner, 2006). The women's responses to eHEALS items were summed and dichotomized into either *lower* or *higher* eHealth literacy using a median split. A median split was used as there was no accepted method to define groups of low and high eHealth literacy using this measure; some studies have used a similar approach (Mitsutake, Shibata, Ishii, Okazaki, & Oka, 2011; Neter & Brainin, 2012), and others have used a different approach (Choi & Dinitto, 2013; Mitsutake, Shibata, Ishii, & Oka, 2012).

Current HIV transmission risk behavior—Due to the study's exploratory nature and modest sample size, the dependent variable was a composite measure of any high-risk sexual or drug use behavior in the previous 30 days (*yes/no*). High-risk sexual behavior was defined as condomless vaginal or anal intercourse in the previous 30 days (HIV Risk-Taking Behaviour Scale [HRBS]; Darke, Hall, Heather, Ward, & Wodak, 1991). High-risk drug use behavior was defined as any illicit drug use in the previous 30 days including heroin, methadone, buprenorphine, prescription opioids, or sedative-hypnotics without a prescription; marijuana; cocaine; or any injection drug use (Addiction Severity Index [ASI]; McLellan, Luborsky, Woody, & O'Brien, 1980).

Covariates—Socio-demographic characteristics included age; race/ethnicity (*non-Hispanic Black, Hispanic, Multiracial/Other*); relationship status (*single, married/partnered*); level of education completed (*less than high school, high school or higher*);

income less than 10,000 USD/year (*yes, no*); and housing status (*lives in own home or apartment, unstably housed or homeless [someone else's home/supportive housing/shelter]*); and being a primary caregiver (*yes, no*). Clinical characteristics included health status (*fair/poor, excellent/very good/good*); any chronic medical condition other than HIV (such as diabetes mellitus, high blood pressure, asthma, heart disease, cancer, hepatitis C; *yes, no*); depression (Center for Epidemiologic Studies Short Depression Scale score ≥ 10 ; *yes, no*; Cole, Rabin, Smith, & Kaufman, 2004); and prescribed antiretroviral medications (*yes, no*). Electronic device ownership included cellphone (*yes/no*) and computer, tablet, or laptop (*yes/no*). Most of these covariates have been found to be associated with Internet access, use, and/or eHealth literacy in prior research (Choi & Dinitto, 2013; Kalichman, Benotsch, Weinhardt, Austin, & Luke, 2002; Kalichman, Weinhardt et al., 2002; Kalichman et al., 2005; Knapp et al., 2011; Kontos, Blake, Chou, & Prestin, 2014; Rice, 2006).

Analysis

First, to examine differences in characteristics by current HIV transmission risk behavior, chi-square and Kruskal-Wallis tests were used. Next, to assess the association between level of eHealth literacy and current HIV transmission risk behavior, variables significant in bivariate analysis were included in a multivariate logistic regression model. Due to the exploratory nature of the study, we selected a level of statistical significance of $p < 0.20$ level for inclusion of covariates in the multivariate model (Andrews et al., 2010; Kimanga et al., 2014). Statistical analyses were performed using SAS 9.2 (SAS Institute, Inc., Cary, North Carolina).

Results

Characteristics of Overall Sample

Of our sample ($n=63$), median age was 49 years old (Table 1). Most women were either non-Hispanic Black (56.7%) or Hispanic (38.3%) and single (66.7%). About one-third (38.7%) had less than a high school education and a similar proportion (34.9%) were unstably housed. The majority (79.0%) reported an annual income of less than 10,000 USD. Almost half (41.3%) were primary caregivers. One-quarter (24.2%) reported fair/poor health status, 38.1% met criteria for depression, and 69.8% had a chronic medical condition other than HIV. Most (85.7%) reported being currently prescribed antiretroviral medications. More than half (57.1%) reported current HIV transmission risk behaviors, with 39.7% reporting recent high-risk sexual behavior and 38.1% reporting recent drug use. Most women owned a cellphone (87.3%) and more than half (58.7%) had a desktop computer, laptop, or tablet.

Association Between eHealth Literacy and HIV Transmission Risk

As shown in Table 1, compared to women reporting no current HIV transmission risk behavior, those reporting current HIV transmission risk behaviors were more likely to be older (50.5 vs. 46 years old, $p=0.03$), to have an annual income less than 10,000 USD (85.3% vs. 69.6%, $p=0.15$), and to have higher eHealth literacy (61.1% vs. 38.9%, $p=0.11$). However, those with current HIV risk behaviors were less likely to report fair/poor health status (33.3% vs. 17.1%, $p=0.15$). There were no significant differences with respect to race/

ethnicity, relationship status, education, housing, being a primary caregiver, depression, having at least one chronic medical condition, or cellphone or other electronic device ownership.

In the multivariate logistic regression analysis (not shown in table), older age(aOR=1.10; 95%CI: 1.02–1.19) and higher eHealth literacy(aOR=3.90, 95% CI: 1.05–14.56) continued to be significantly associated with current HIV transmission risk behaviors, adjusted for income and self-perceived health status.

Discussion

In this exploratory study, we sought to examine the association between eHealth literacy and HIV transmission risk behavior in an urban, community-based sample of HIV-infected Internet-using women. We found that more than half of the women in our sample reported current HIV transmission risk behavior. Compared to those with lower eHealth literacy, women with higher eHealth literacy were more likely to report current HIV transmission risk behavior, even after controlling for age, income, and self-perceived health status.

These findings contribute to our understanding of the relationship between eHealth literacy and HIV risk behavior in U.S. women living with HIV in several important ways. First, our study was unique in that it specifically examined the topic of eHealth literacy in women with HIV, many of whom were socioeconomically disadvantaged. As eHealth technology expands to reach marginalized groups, such as women with HIV, understanding how eHealth literacy may be associated with risk behavior will help to shape intervention content and delivery. Second, while studies have characterized Internet use for general and health-related purposes in samples of people living with HIV (which included women), none— to our knowledge — assessed the relatively newer construct of eHealth literacy(Mayben & Giordano, 2007; Thomas & Shuter, 2010). Third, although we found higher eHealth literacy to be associated with sexual and drug use risk behaviors in our sample of HIV-infected women, studies of eHealth literacy in different populations and contexts have often shown that eHealth literacy was associated with more positive health behaviors including knowledge, information seeking, and seeking preventive health services (Mitsutake et al., 2012; Park, Moon, & Baeg, 2014). This suggests that factors associated with eHealth literacy may vary between patient populations based on the unique social context and study design.

We believe our findings have potentially important implications for the development of eHealth interventions focused on women living with HIV. Online platforms may provide an opportunity to reach women living with HIV who may be involved in high-risk behaviors. We are aware of only two eHealth interventions specifically focused on reducing risk behaviors in women with HIV(Klein et al., 2013; Marhefka et al., 2014). The dearth of such interventions suggests missed opportunities for reaching HIV-infected women. As our research has suggested, the acceptability and feasibility of such interventions may be further enhanced by providing access to electronic devices and/or being based at CBOs where participants have ready access to the Internet(Blackstock et al., 2015; Blackstock, Shah, Haughton, Horvath, & Cunningham, 2014). Additionally, HIV-infected women with lower

eHealth literacy may be targets for eHealth interventions that integrate Internet skills training into the actual intervention itself (Blackstock et al., 2015; Blackstock et al., 2014).

Our exploratory study is not without limitations. First, our measure of eHealth literacy, eHEALS, assessed perceived eHealth literacy. Therefore, it is possible that the women may have perceived that they had the ability to find, navigate, and apply electronic health information, but objectively may not have had the skills to do so. Second, we did not assess participants' general health literacy due to survey time constraints. However, our study was focused on providing formative data to inform the development of eHealth interventions for women with HIV; therefore, we focused specifically on the construct of eHealth literacy. Third, as women in our study were recruited from an urban setting, we do not know whether our study results are generalizable to women living with HIV in rural areas of the United States. Fourth, our composite measure of HIV transmission risk behaviors included condomless sex. However, a majority of women in our study reported being prescribed antiretrovirals and, therefore, might have been virally suppressed, thereby decreasing the risk of transmitting HIV. Future studies should collect viral load data and examine how suppressed viral load may affect the association between eHealth literacy and risk behaviors. Lastly, our small sample size may have limited our ability to detect other important differences that may have affected the relationship between eHealth literacy and HIV risk behaviors. However, our sample was unique and our findings may be generalizable to women with HIV living in urban settings. Additional research is needed to assess these relationships in larger samples of women living with HIV.

Conclusions

As eHealth technology is increasingly used to deliver HIV-related behavioral interventions, greater understanding of eHealth literacy among women living with HIV is essential to tailor these interventions to women's unique needs and preferences. Given the finding that higher eHealth literacy was associated with HIV transmission risk behaviors in women with HIV, eHealth interventions may be acceptable to women at highest risk and, therefore, may be leveraged to provide information, risk reduction skills, and support to improve health outcomes.

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Table 1

Bivariate Associations Between eHealth Literacy/Covariates and Current HIV Transmission Risk Behavior (n=63)

	Total sample N=63	No HIV risk behavior n=27	HIV risk behavior n=36	p
High eHealth literacy ^a , n(%)	-	11 (40.7%)	22 (61.1%)	.11
Age (years), median, (IQR)	49 (44–54)	46 (43–51)	50.5 (45.5–54.5)	.03
Race/ethnicity, n (%)				
Non-Hispanic Black	34 (56.7%)	14 (56.0%)	20 (57.1%)	.94
Hispanic	23 (38.3%)	10 (40.0%)	13 (37.1%)	
Multiracial/Other	3 (5.0%)	1 (4.0%)	1 (5.7%)	
Relationship status, single, n (%)	36 (66.7%)	17 (73.9%)	19 (61.3%)	.33
Less than high school education, n (%)	24 (38.7%)	12 (46.2%)	12 (33.3%)	.31
Income less than 10,000 USD/year, n (%)	45 (79.0%)	16 (69.6%)	29 (85.3%)	.15
Unstably housed, n (%)	22 (34.9%)	10 (37.0%)	12 (33.3%)	.76
Primary caregiver, n (%)	26 (41.3%)	11 (40.7%)	15 (41.7%)	.94
Fair/poor health status, n (%)	15 (24.2%)	9 (33.3%)	6 (17.1%)	.14
Depression, n (%)	24 (38.1%)	11 (40.7%)	13 (36.1%)	.70
Chronic medical condition, n (%)	44 (69.8%)	20 (74.1%)	24 (66.7%)	.53
Prescribed antiretroviral medications, n (%)	54 (85.7%)	23 (85.2%)	31 (86.1%)	.92
Cellphone ownership, n (%)	55 (87.3%)	25 (92.6%)	30 (83.3%)	.27
Desktop computer, laptop, or tablet ownership, n (%)	37 (58.7%)	16 (59.3%)	21 (58.3%)	.94

Note. IQR=interquartile range; USD=U.S. dollars

^aeHealth literacy dichotomized at the median