Understanding Women's Willingness to Use e-Health for HIV-Related Services: A Novel Application of the Technology Readiness and Acceptance Model to a Highly Stigmatized Medical Condition

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Abstract

Background: E-health may expand access to effective behavioral interventions for women living with HIV (WLH), and others living with a highly stigmatized medical condition.

Introduction: Theory may help us to understand e-health program uptake. This mixed methods study examined theoretical applications of the Technology Readiness and Acceptance Model (TRAM) to predict willingness to take part in an e-health videoconferencing group program (i.e., participants interacting with each other in real time via videoconferencing) among a group of WLH.

Materials and Methods: Women were recruited from HIV/AIDS clinics in an urban area of the southeastern United States. Each participant completed a structured interview. Data were analyzed using a parallel convergent mixed methods design.

Results: Participants (N=91) had a mean age of 43 years and were primarily African American (66%). Despite limited experience with videoconferencing (14.3%), many (71%) reported willingness to attend an intervention via video group for WLH. Qualitative analysis revealed that the constructs of the TRAM (Innovativeness, Optimism, Discomfort, Insecurity, Perceived Usefulness, or Perceived Ease-of-Use) were evident; however, additional mediating factors specific to WLH emerged, including group readiness and HIV-related privacy concerns. **Discussion:** Group readiness and privacy concerns may be important considerations when applying the TRAM to technology-based group programs for highly stigmatized populations, including WLH.

Conclusions: Existing theoretical frameworks may be useful in understanding the willingness of people to take part in group-based e-health interventions, but may need to be modified to account for the role of stigma in e-health program uptake.

Keywords: telemedicine, videoconferencing, HIV, technology, e-health, stigma

Introduction

The stigmatization of health conditions is far reaching, including a variety of physical and mental health conditions.¹⁻⁵ Such stigmatization often results in decreased uptake of healthcare and social-behavioral services related to the stigmatized health condition.^{6,7} Some researchers have suggested that delivering healthcare interventions via e-health modalities may reduce stigma.^{8,9} However, it remains to be seen if such stigmatized conditions could be helped or hampered by the growing trend of e-health¹⁰ (e.g., use of text messaging, apps, videoconferencing, wearables, or secure portals).

HIV is one such stigmatized health condition. In the United States, women account for 19% of people living with HIV (PLH).¹¹ Women living with HIV (WLH) face challenges associated with managing HIV disclosure and resulting stigma, and meeting sexual and reproductive desires while reducing the risk of transmitting HIV to partners and offspring.¹²⁻¹⁵ Behavioral interventions have been developed and tested to help WLH cope with challenges and experience better health outcomes.¹⁶⁻¹⁸

Increasingly, more widespread access to, and use of, internet-based and text-messaging technologies has led to the development of new interventions and the adaptation of existing HIV-related interventions for e-health delivery.¹⁹⁻²¹ However, uptake of e-health interventions is slow.²² In addition, development of e-health interventions for PLH has primarily focused on men who have sex with men, young adults, and adolescents.^{19,23,24} Theory-based approaches to understand WLH's willingness to adopt HIV-specific e-health programs are critical for planning program dissemination and adoption.

Theoretical approaches have attempted to explain technology uptake; however, thus far, most theoretical approaches have not been specific to e-health or group-based interventions. One of the most widely applied technology frameworks,

the technology acceptance model (TAM), has been exhaustively used to predict behavioral intention to use technology through its constructs of perceived ease of use and perceived usefulness,^{25,26} but seldom applied to e-health interventions. There has also been limited application of the TAM to HIV research. Existing applications of the TAM to HIV include behavioral research to assess perceived usefulness and perceived ease of use of a computer-based intervention²⁷ and an investigation of the electronic record keeping of HIV case managers.²⁸ More recently, researchers have incorporated the Technology Readiness Index (TRI²⁹) into the TAM,^{25,26} which involves consideration of the TRI constructs of innovativeness, optimism, discomfort, and insecurity, resulting in the Technology Readiness and Acceptance Model (TRAM).³⁰ While this theory has not yet been used in HIV-related research, the theory's application in the present study may help explain WLH's willingness to take part in e-health group interventions.

There is little empirical information on how willingness of WLH to engage in e-health is related to TRAM constructs (Innovativeness, Optimism, Discomfort, Insecurity, Perceived Usefulness, and Perceived). Moreover, there is little empirical data to demonstrate the extent to which WLH may be willing to engage in HIV-specific e-health interventions and the perceived advantages and disadvantages to participation.³¹ Such information is essential for successfully developing and marketing e-health interventions to WLH and may be applicable to other highly stigmatized populations.

The present study examines, among WLH, theoretical constructs of the TRAM in relation to WLH's willingness to take part in video groups. We hypothesized that the constructs of the TRAM will be present in our qualitative data, indicating they are related to willingness to use HIV-specific group-based videoconferencing e-health programs among WLH.

Materials and Methods

PROCEDURES

A parallel convergent mixed methods design was utilized.³² Quantitative data measured willingness to engage in video groups, technology experience, and demographic characteristics. Qualitative data collection was used to understand the fit of the TRAM constructs within the context of group-based e-health interventions involving a highly stigmatized condition. All study procedures and data collection instruments were reviewed and approved by the Institutional Review Boards at the Florida Department of Health, University of South Florida, and St. Joseph's Hospital. Participants were recruited Spring 2010 while obtaining routine HIV-related

medical care from three HIV/AIDS clinics in an urban area of the southeastern United States.

Study staff met with interested participants in a private room at each clinic site to explain the study, assess eligibility, and complete informed consent procedures. Eligible participants were ≥ 18 years old, female, and were currently receiving HIV-related care from a participating clinic. Participants completed a 30-min structured interview verbally with a trained research assistant and were compensated with a \$10.00 gift card.

MEASURES

Participants reported demographic and HIV transmission information, experience and comfort with computers, experience attending group-based programs for PLH, and willingness to (1) attend a group-based program for PLH (yes, no, or maybe) and (2) attend a synchronous prescheduled program for WLH via a closed video group (yes, no, or maybe). Participants were also asked what would make them *want* and *not want* to participate in a video group program for WLH. These data were documented by the study staff member on paper and analyzed qualitatively. The TRAM constructs were operationalized based on the theoretical definitions,³⁰ as outlined in Table 1.

DATA ANALYSIS

Qualitative analyses were conducted by first printing out transcripts that were read by two coders (D.T. and S.M.). The

Table 1. Operationalization of the Technology Readiness and Acceptance Model^a Constructs

TRAM CONSTRUCT	OPERATIONALIZATION
Innovativeness	Willingness to participate in a technology-based program because the program is new, different, or innovative
Optimism	Increased opportunity, comfort, control, flexibility, and efficiency associated with the use of technology
Discomfort	Perceived lack of control over technology and being overwhelmed by technology-based programs
Insecurity	Distrust of technology and skepticism about its ability to work properly
Perceived usefulness	Extent to which participating in a technology-based program with other WLH would facilitate group intervention behaviors, including sharing with others, teaching, and reciprocity
Perceived ease of use	Extent to which participating in an <i>e-health</i> program with other WLH would be easy to do, including using the technology

^aSee Ref.²⁶

WLH, women living with HIV.

researchers continued by coding, displaying, and reducing³⁴ the data without specialized software.^{34,35} As fairly standard for applied thematic analysis, we first aligned data with the constructs of our theoretical framework³⁵ (TRAM³⁰) that involved identifying a-priori themes aligned with the constructs of the TRAM³⁰ and additionally identified emergent codes³⁵ regarding specific factors that might affect willingness to participate in a video group for PLH. After initially reading all responses, a codebook was developed by two coders (D.T. and S.M.), tested, and revised by members of the coding team. Two coders (D.T. and S.M.) conducted final coding, then met to discuss coding discrepancies and reach consensus on codes. Further analyses involved three authors (D.T., S.M., E.L.) comparing and contrasting codes and writing and revising the narrative.

Quantitative data analyses were conducted using IBM SPSS® Statistics v.20.³³ (IBM Corp. Released 2011. IBM SPSS Statistics for Windows. Version 20.0. Armonk, NY: IBM Corp.) Descriptive statistics were conducted for all variables. Bivariate and multivariable logistic regression analyses were used to assess differences in willingness to participate in a video group for WLH. Statistical significance was set at $p < 0.05$.

Results

PARTICIPANT CHARACTERISTICS

Among 91 WLH participants, the mean age was 43.41 years ($SD=9.48$; *Table 2*). Most identified as black/African American (65.9%), not married (83.5%), $\geq$ high school education (61.6%), and not employed for pay (77.0%; *Table 2*). Additional participant characteristics, including technology use and comfort can be found in *Table 2*.

WILLINGNESS TO ENGAGE IN VIDEO GROUPS

Nearly three-quarters of participants (71.4%) stated they *would be willing* to join a computer/internet-based video group for WLH and 12.1% stated that they *might be willing* to do so.

FIT WITH CONSTRUCTS OF TRAM

Relevance of TRAM constructs for video group willingness among WLH. Reasons given for willingness/lack of willingness to use video groups were related to *Perceived Usefulness* and *Perceived Ease-of-Use*, *Innovativeness*, *Optimism*, *Insecurity*, and *Discomfort*. When asked about potential advantages of participating in a video group program for WLH, most women discussed the *Perceived Usefulness* of being involved in a group with WLH, including opportunities for mutual sharing of information and experiences, helping others, increasing knowledge, and learning about coping strategies from others. One important component of perceived usefulness was the

anticipated reciprocal nature of video group participation. This theme emerged through statements such as this one about relating "...to someone who is going through the same thing as you, and hear their opinions." While *perceived ease-of-use* is not directly apparent in the data, participant statements regarding training needs for computer use suggest ease of use may be an important construct in the model nonetheless.

Both *Innovation* and *Optimism* acted as advantages to video group engagement. Participants indicated *Innovativeness* as a perceived advantage of taking part in a video group for WLH, for example: "It's something different. I may talk to someone in another place [who] has been living with it [HIV] much longer than I have." Regarding *Optimism*, the ability to connect with geographically diverse participants was noted: "Talking with other women throughout the country ... You are doing something positive." Participants also noted the benefits of accessing the intervention at a variety of locations, including e-health stations set up at AIDS Service Organizations or within a participant's home: "To be able to share hope, strength, and experiences with others ... might be a little more private doing it on a computer ... able to link but still in your own space." Some participants noted increased comfort with the video group delivery, compared with in-person delivery: "[I] could feel more comfortable being on a computer rather than face-to-face."

Certain TRAM constructs were often presented as perceived disadvantages of participating in video groups. For example, *Insecurity*: "I would think it was not totally safe. Similar to an online social network." Another participant stated, "I would be concerned [about] who would have access and listen to the conversation." Also, *Discomfort* related to perceived lack of control over technology or being overwhelmed by technology-based programs; typically, related comments mentioned a need for training or hesitation about computer use.

Emergent themes for consideration in application for e-health interventions among PLH. While our findings suggest that the constructs of the TRAM are present in the data, emerging constructs specific to WLH may act to moderate these findings. Confidentiality and privacy concerns regarding a participant's HIV status—not specific to the use of technology—seemed to affect willingness. While these concerns were independent of intervention delivery modality (in person vs. videoconferencing), they may affect willingness to participate in a video group. For example: "[I'm] very concerned about privacy and seeing someone you know or being judged that you have HIV." In addition, concerns related to *Group Readiness* emerged in the data. Participants expressed concern regarding personality traits of group members, such as the perceived

Table 2. Participant Characteristics (N= 91)

CHARACTERISTIC	
AGE (RANGE = 22–65 YEARS)	MEAN = 43.41, SD = 9.48, n (%)
Race/ethnicity ^{a,b}	
Black or African American	60 (65.9)
White or Caucasian	17 (18.7)
Hispanic or Latina	15 (16.5)
Marital status	
Single	47 (51.6)
Married	15 (16.5)
Legally separated	6 (6.6)
Divorced	16 (17.6)
Widowed	7 (7.8)
Education completed	
Less than high school	35 (38.5)
High school or equivalent	31 (34.1)
Some college or technical school but no 4-year degree	22 (24.2)
4-Year degree	3 (3.3)
Employment	
Full-time	11 (12.1)
Part-time	10 (11.0)
Retired	5 (5.5)
Disabled	22 (24.2)
Not employed	43 (47.3)
Suspected HIV transmission mode ^a	
Sexual behavior	79 (86.8)
Injection drug use	4 (4.7)
Blood transfusion	5 (5.5)
Other/do not know	5 (5.5)
Experience with computers	
Never used	12 (13.2)
Ever used	79 (86.8)
Has computer at home	
No	39 (49.4)
Yes	40 (50.6)
Comfort with computers	
Very uncomfortable	15 (16.5)

continued →

Table 2. continued

CHARACTERISTIC	
AGE (RANGE = 22–65 YEARS)	MEAN = 43.41, SD = 9.48, n (%)
Uncomfortable	14 (15.4)
Comfortable	37 (40.7)
Very comfortable	25 (27.5)
Internet use	
Daily	25 (31.6)
3–5 Days a week	9 (11.4)
1–2 Days a week	8 (10.1)
Every few weeks	7 (8.9)
Less often	12 (15.2)
Never	18 (22.8)
Ever participated in video chatting/videoconferencing	
No	66 (83.5)
Yes	13 (16.5)
Ever having participated in a group-based program for PLH	
No	41 (66.1)
Yes	21 (33.9)
Future willingness to participate in any group for PLH	
No	9 (9.9)
Maybe	7 (7.7)
Yes	75 (82.4)

^aMay not add to 100% because some respondents selected multiple answers.^bOne participant identified as American Indian/Alaskan Native and one participant identified as Asian.

PLH, people living with HIV.

disadvantages of “dealing with perverts or weird people, or strange people” or “people [who]...bring negativity into the environment.”

ADDITIONAL CONSIDERATIONS FOR APPLICATION OF TRAM FOR GROUP-BASED E-HEALTH INTERVENTIONS

When asked about potential disadvantages, 42 women (46%) mentioned general disadvantages of participating in groups for WLH; 25 (27%) pointed to disadvantages that were specific to the video group modality. Of the 25 participants who pointed to technology-specific disadvantages, only 7 said

Table 3. Factors Affecting Willingness to Participate in a Group for Women Living with HIV via Videoconferencing (N= 91)

FACTOR	WILLING TO PARTICIPATE IN A VIDEO GROUP FOR WLH, <i>n</i> (%)	BIVARIATE ODDS RATIO (95% CONFIDENCE INTERVAL)	<i>p</i>	ADJUSTED ODDS RATIO ^a (95% CONFIDENCE INTERVAL)	<i>p</i>
Age	—	1.00 (0.95–1.05)		1.02 (0.96–1.08)	
Race					
Non-black	20 (64.5)	1.00		1.00	
Black	45 (75.0)	1.43 (0.56–3.64)	0.45	1.54 (0.55–4.32)	0.41
Ethnicity					
Non-Hispanic	57 (75.0)	1.00		1.00	
Hispanic	8 (53.3)	0.38 (0.12–1.19)	0.10	0.34 (0.10–1.20)	0.10
Education					
Less than high school	28 (80.0)	1.00		1.00	
At least high school education	37 (66.1)	0.49 (0.18–1.32)	0.16	0.58 (0.19–1.78)	0.34
Marital status					
Nonmarried or legally separated	57 (75.0)	1.00		1.00	
Married	8 (53.3)	0.38 (0.12–1.19)	0.10	0.46 (0.13–1.35)	0.24
Experience with computers					
Never used	6 (50.0)	1.00		1.00	
Ever used	59 (74.7)	2.95 (0.85–10.19)	0.09	3.76 (0.98–14.42)	0.05
Has computer at home					
No	31 (79.5)	1.00		1.00	
Yes	28 (70.0)	0.60 (0.22–1.69)	0.34	0.71 (0.21–2.36)	0.57
Comfort with computers					
Uncomfortable	18 (62.1)	1.00		1.00	
Comfortable	47 (75.8)	1.92 (0.74–4.95)	0.18	1.81 (0.62–5.26)	0.28
Internet use					
Never	20 (66.7)	1.00		1.00	
Ever	45 (73.8)	0.80 (0.23–2.80)	0.73	0.56 (0.13–2.47)	0.44
Ever participated in video chatting/videoconferencing					
No	50 (75.8)	1.00		1.00	
Yes	9 (69.2)	0.72 (0.20–2.66)	0.62	0.73 (0.15–3.46)	0.69
Future willingness to participate in any group for people living with HIV					
No	2 (22.2)	1.00		—	
Maybe	3 (42.9)	2.63 (0.30–23.00)	0.38	—	
Yes	60 (80.0)	14 (2.64–74.39)	0.002*	—	

^aAdjusted for future willingness to participate in a group for women living with HIV.*Significant at $p < 0.05$.

they would not be willing to participate in a video group. Thus, while some participants may identify perceived disadvantages, these perceptions may not affect future participation.

In bivariate analyses (Table 2), the only statistically significant factor associated with willingness to join a computer-based video group for WLH was *general willingness* to participate in any group, in-person or otherwise, for PLH at some time in the future. In a multivariable logistic regression analysis adjusting for *general willingness* to participate in a group for PLH (Table 3), no demographic or computer/internet/ videoconferencing use or comfort variables were significantly associated with willingness to participate in a video group for PLH.

Discussion

This study examined willingness of WLH to take part in video groups using the theoretical lens of the TRAM. The TRAM constructs appeared to help explain WLH's willingness to participate in video group interventions. However, these constructs may be of varied importance when used to predict intervention participation intentions among PLH or other highly stigmatized groups. Beyond the constructs of comfort, insecurity, innovativeness, and perceived ease of use, participants overwhelmingly indicated that sharing and receiving information from others and reciprocity between women were the greatest drivers of willingness to participate in WLH-specific video groups.

Our results suggest many WLH may be willing to participate in computer/internet technology-based interventions, even if they have little or no experience with the technology. While there have been many technology-based programs developed for PLH,^{36–39} very few of them have been developed based on technology-related.^{40,41}

Perceived advantages of participating in a video group e-health delivery of an intervention were largely related to a desire to give and receive social support—not related to the

technology. Similar benefits have been reported among PLH who attend in-person support groups.^{42,43} Perceived disadvantages of the proposed video group delivery method included a mix of technology- and nontechnology-related factors. The most frequently mentioned perceived disadvantage of a video group intervention was a general discomfort with, or lack of interest in, group-based programs for WLH. Technology-related concerns referenced lack of experience with computers as well as concerns about privacy, confidentiality, and ensuring that groups were inaccessible by those not living with HIV—a finding consistent with that from a previous in-depth, qualitative exploration of WLH's interests and concerns with participation in a video group program.⁴⁴ Although these concerns may not prevent most women from participating in e-health groups, attending to these concerns may increase program uptake.

PROPOSED MODERATED MODEL

Given the paucity of theoretical applications for studying group-based e-health intervention uptake, we suggest a moderated TRAM may be useful for assessing video group participation among WLH (Fig. 1). This model contains the original constructs of the TRAM,³⁰ along with the moderating factors *Group Readiness* and *HIV-related Privacy Concerns*, as suggested by our present findings.

The rate of computer use in our study was more than 15% higher than rates among PLH identified by Kalichman et al.⁴⁵ nearly a decade before, and comparatively, the proportion of internet users (defined in this study as those who use the internet at least every few weeks) increased by nearly 40%. Women in this study had more home computers with internet access (37.4%) than a study of low-income PLH in Houston, TX, published in 2007 (29%).⁴⁶ Both rates are lower than those in a similar study of PLH in Bronx, NY (51.7%).⁴⁷ Such findings suggest geographical differences may be an important determinant

Fig. 1. Hypothesized application of the TRAM for group-based e-health interventions among people living with highly stigmatized conditions (TRAM-GHS). TRAM, Technology Readiness and Acceptance Model.

of technology access for this population. Despite the data being from 2010, these data can assist us in understanding the theoretical applications of the TRAM to e-health programs designed for addressing a stigmatized health condition.

The potential for e-health interventions is exciting, especially as new technologies are developed and others become more ubiquitous (e.g., smartphones). Although e-health interventions for WLH could be accessible in public locations such as libraries, the sensitive nature of such interventions may prevent WLH from accessing them publicly due to fears of inadvertent disclosure and related stigma.⁴⁴ In fact, the same concerns may prevent some WLH from accessing e-health interventions at home, where family members and others may be uninformed of a participant's HIV status.⁴⁴

This study has implications for behavioral and psychosocial interventions provided by clinics and community-based organizations serving PLH or other stigmatized populations. Several studies have demonstrated the feasibility of offering computer and/or internet-based interventions for PLH in locations throughout the community.^{27,40,41,48–53} It is not uncommon for HIV-related community organizations to provide computer access to their clients; if trusted community organizations provided some computers in private room,⁵³ attending video group interventions may be a reality for those who lack their own devices or consistent internet service. In addition, although not systematically studied, we believe such options could reduce the costs of group-based behavioral interventions while broadening the reach. Ultimately, expanded access will likely be best achieved with a menu of options⁵⁴ so WLH can choose a program, format (group vs. individual), delivery modality (internet based or in person) and location (agency, home, or other) that meet their needs.

In terms of strengths, this study adds to the existing literature related to e-health interventions for PLH and other stigmatized populations, yet some limitations must be noted. The data are from 2010, and the sample size ($N=91$) is relatively small and consisted of adult women (ages 22–65) recruited from a single metropolitan area; therefore, findings may underestimate current technology use and video group willingness and not be generalizable to other geographical areas or demographic groups (e.g., younger populations). However, as the first study to use the TRAM among PLH, this investigation demonstrates the potential value of a modified TRAM for understanding willingness to engage in e-health programming related to a highly stigmatized condition.

Conclusions

To our knowledge, this research is the first application of the TRAM to HIV—a highly stigmatized medical condition.

Results indicate promise for applying the TRAM to e-health programs to increase participation. Further research needs to explore the applicability of the TRAM to other populations, including other stigmatized health conditions. In addition, there is a need for quantitative measure development specifically to address e-health uptake in populations affected by highly stigmatized medical conditions.

Disclosure Statement

No competing financial interests exist.

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