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ORIGINAL PAPER

WiLLOW: Reaching HIV-Positive African-American Women Through a Computer-Delivered Intervention

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Abstract WiLLOW is an evidence-based, group level HIV prevention program for African-American women living with HIV. This study evaluated the efficacy of a multimedia adaptation of WiLLOW in enhancing protective sexual behaviors and psychosocial mediators associated with HIV risk reduction. Using a randomized controlled design, 168 participants completed baseline, satisfaction, and three-month follow-up assessments. At follow-up intervention participants reported higher proportions of condom protected sex acts ($p = .002$) with both HIV-negative ($p = .040$) and HIV-positive ($p = .003$) partners. They were also more likely to report 100 % condom use (OR = 9.67; $p = .03$); fewer unprotected vaginal and anal sex acts ($p = .002$); significantly greater sexual communication self-efficacy ($p = .004$); and less stress ($p = .012$). Participants rated Multimedia WiLLOW favorably in four satisfaction categories—enjoyment ($p < .001$); information utility ($p = .018$); information clarity ($p = .015$) and held attention ($p = .01$).

Resumen El programa WiLLOW está desarrollado a nivel de grupo para la prevención del VIH en mujeres afroamericanas viviendo con el virus. Este estudio evaluó la eficacia de una adaptación multimedia de WiLLOW para fomentar conductas sexuales protectoras y mediadores psicosociales asociados con la reducción de prácticas de riesgo del VIH. Usando un diseño aleatoriamente controlado, 168 participantes completaron una encuesta basal, un estudio de satisfacción, y tres meses después una evaluación de seguimiento. Las participantes de la intervención reportaron proporciones significativamente altas de actos sexuales protegidos con condón en los últimos 30 días ($p = .002$) tanto para parejas VIH negativo ($p = .04$) como VIH positivo ($p = .003$). Hubo también una mayor probabilidad de reportar al 100 % el uso de condón (OR = 9.67; $p = .03$); un promedio ajustado inferior de actos sexuales vaginales y anales desprotegidos en los últimos 30 días ($p = .002$); comunicación sexual auto eficaz ($p = .004$) altamente significativa; y menos estrés ($p = .012$). Las participantes evaluaron favorablemente Multimedia WiLLOW en cuatro categorías de satisfacción: ameno ($p < .001$), información útil ($p = .018$), claridad de la información ($p = .015$) y captación la atención ($p = .01$).

Keywords HIV-positive · Risk reduction · African-American women · Evidence-based programs · Computer-delivered interventions

Palabras clave VIH-positivo, Reducción del riesgo · Mujeres afroamericanas · Programas basados en evidencias · Intervenciones a través de la computadora

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Introduction

HIV/AIDS has disproportionately affected African-American women since the beginning of the epidemic. Over 63 % of the estimated 310,000 women living with HIV/AIDS in the US are African-American, even though African

Americans represent only 14 % of the US population [1–5]. In 2009, the rate of new HIV infection for African-American women was fifteen times as high as that of white women and three times that of Hispanic/Latina women [4]. At some point in their lifetimes, the CDC estimates that one in 32 African-American women will be diagnosed with HIV [4], and HIV disease is currently the third leading cause of death for African-American women aged 35–44 [4].

In response to this striking health disparity, researchers and practitioners have developed evidence-based programs specifically targeting African-American women, including Wingood and DiClemente's popular suite of group level interventions for adult women (SISTA); HIV-positive women (WiLLOW); adolescent females (SiHLE) and adolescent females seeking sexual health services (HORIZONS) [6–11]. Yet despite the existence of user-friendly replication kits [12, 13] and trainings through the CDC's Diffusion of Evidence-based Interventions (DEBI) initiative [14, 15], the implementation of evidence-based HIV prevention interventions among HIV-positive African-American women has been impeded due to financial constraints, staff and agency capacity, poor implementation fidelity, and recruitment and retention issues [16–20].

Seeking to address these implementation challenges and expand the reach of evidence-based programs among African-American women, Sociometrics Corporation developed, with funding from the National Institute of Mental Health, computer-delivered versions of the SISTA/SiHLE/WiLLOW HIV prevention trilogy. Each multimedia program is ~2 h long and combines visual and audio presentations, interactive elements (e.g., games, quizzes, click and drag, role-plays, list creation), video recordings of group discussions from the original program, and a brief multimedia intervention tutorial so that users with limited computer literacy can easily use the programs. In recent randomized-controlled outcome studies, SAHARA (the computer-delivered version of SISTA) [21] and Multimedia SiHLE [22] both demonstrated preliminary efficacy in reducing HIV risk. For SAHARA, women in the intervention arm reported a significantly higher percentage of condom protected sex acts [intervention = 85.3 % (SD = 10.1) versus control = 52.8 % (SD = 9.5), $p = .03$] and were more likely to use condoms consistently for vaginal [OR = 5.9; $P < .04$] and oral sex [OR = 13.83; $P < .04$], compared to women in the control condition. For Multimedia SiHLE, average proportion of condom-protected sex acts (proportion of vaginal sex acts with condoms, last 3 months) for sexually active participants receiving Multimedia SIHLE rose from $M = 51$ % at baseline to $M = 71$ % at 3-month follow-up [$t = 2.06$, $p = .05$]; no statistically significant difference was found in the control group [22]. These findings support the idea that computer adaptations of existing evidence-based interventions hold promise in reducing HIV risk behaviors [23].

This study evaluated the efficacy of Multimedia WiLLOW (Women Involved in Life Learning from Other Women) in enhancing HIV-protective sexual behaviors and psychosocial outcomes among HIV-positive African-American women, and secondarily assessed women's receptivity to a computer-delivered HIV prevention program. The original WiLLOW program is a face-to-face, educational and skills building intervention developed specifically for American women living with HIV [10, 11, 14]. Two African-American women, one of whom is HIV-positive, co-facilitate the 16 h long program, which is divided into four sessions: (1) Pride, values, and goals: using social support; (2) stress management: changing what your think, changing what you do; (3) risk reduction and condom management; and (4) building healthy relationships, and it's your turn, in which participants practice being peer educators (see Table 1). Activities focus particular attention on HIV re-infection, sexually transmitted infections (STIs), and key factors that have been linked to HIV risk behaviors among HIV-positive African-American women, such as partner communication [24], condom self-efficacy [25], and HIV status disclosure [26, 27]. Building on social cognitive theory, each session includes modeling activities to develop skills, self-management behaviors and risk-reduction strategies to maintain healthy behaviors and relationships [10, 28]. The program's extended exploration of social support additionally builds on the theory of gender and power [29, 30] and its recognition that societal expectations of women as caregivers constrain many HIV-positive women's ability to access social support networks [10]. This lack of social support can lead to stress and depression, which have been linked to higher levels of HIV risk behavior [10, 24, 31].

Adaptation Process

The adaptation of WiLLOW into Multimedia WiLLOW followed the same successful process that Sociometrics used to create SAHARA and Multimedia SiHLE [21, 22]. The development team first translated each of the original program's activities into a multimedia equivalent (see Table 1). The original WiLLOW developers reviewed this outline to ensure that the multimedia adaptation includes each of the original program's eight core elements, that is, the components identified as embodying the program logic model and believed to generate its positive outcomes [14]. Through this process, the development team transformed the four, 4 h sessions into two, 1 h sessions, each broken into 2–8 min activity modules (see Table 1). The team then created storyboards for each module, designed a visual template, selected images, composed a narration script, and filmed and created clips of an enactment of several WiLLOW activities directed by a member of the original

Table 1 Multimedia WiLLOW Content

Face-to-Face WiLLOW	Multimedia WiLLOW
Session 1—Pride, values & goals: using social support	*Session 1—Change what you think, change what you do*
1. Welcome, introductions, and ground rules. WiLLOW motto.	1. Narrated introduction, poem, tutorial on how to use mouse and program. WiLLOW motto, introduction of Sistas (video clips).
2. Discussion of positive aspects of being an African-American woman and identification of African-American women role models.	2. Thought questions presented in text and audio formats; after each, screen freezes for user to reflect on their responses. User can also click on photos to see/hear the responses of other African-American women.
3. Personal values clarification activity—participants identify values most important to them.	3. Presentation followed by interactive exercise in which user prioritizes values by clicking and dragging them. Presentation of thought questions and video clip showing African-American women discussing their values and how they have changed in the face of HIV.
4. Goal setting: making contracts with self for long- and short-term goals.	4. Users set a short-term and a long-term goal and enter them on the screen. Discussion of importance of providing rewards for achieving goals; users enter a reward for each goal. Creation of customized goals and rewards page.
5. Introduction to social support: who loves you, Who do you love?	5. Introduction of social support followed by interactive activity to create visual depiction of people in the viewer's support network.
6. Types, benefits and qualities of social support.	6. Series of screens presents types of social support (i.e. emotional, informational, practical) in text, icons, and audio. Video clips of Sistas discussing social support in their lives.
7. Who is in your support network?	[See 5. above]
8. Informational support, practical support and emotional support: what are they, what are the barriers?	7. Series of screens presents a discussion of barriers to accessing different types of social support.
9. Developing a resource list and saying thanks to those who help.	8. Presentation about importance of having a list of people to turn to for different types of assistance and methods of thanking helpers in appropriate ways.
10. Session review.	
Session 2: Stress management: changing what you think, changing what you do	
1. Welcome, motto, review, thought for the day.	
2. What is stress? The effects of stress, coping with stress, determining if a situation is changeable.	9. Health educator discusses stress and its impacts on the body of someone living with HIV (augmented with audio and visuals); learning to manage stress, learning that values and resources can influence how we respond to stressors.
3. RELAX model for coping with stress.	10. Viewer is introduced to relaxation techniques via narration with visuals.
4. Express yourself: express anger, let others in on the problem, allow positive thoughts.	11. Video clips of Sistas discussing coping with stress through RELAX model.
5. Let's exercise!	
6. Passive, aggressive & assertive communication	12. Narrative discussion of different communication types and video clips of Sistas reenacting each of the three communication styles.
7. Calling your social worker	
8. Relationships and communication: role play	13. Quiz in which viewers match audio clips with one of the three communication types.
9. Coping with stress: the DECIDE model	14. Mouse-over activity introducing the DECIDE model for problem solving/stress reduction.
10. Goal setting and session review.	15. Brief review and reminder to return for session 2.
Session 3: Risk reduction & condom use management	*Session 2: Risk reduction, condoms and relationships*
1. Introduction & thought for the day.	1. Poem and introduction.
2. Facts about STIs and HIV reinfection.	2. Click and drag activity to convey definitions, symptoms and treatment for seven STIs, including HIV. Narration with visuals on STI transmission, symptoms, treatment, and prevention strategies. Interactive quiz reinforces STI knowledge acquisition. Narration with visuals on HIV transmission/reinfection facts and misconceptions and importance of HIV-positive women using condoms. Interactive quiz reinforces HIV reinfection knowledge.

Table 1 continued

Face-to-Face WiLLOW	Multimedia WiLLOW
3. Card swap game: how STIs and HIV are transmitted.	3. Video clip of women engaging in a game showing how STI/HIV transmission occurs, followed by discussion of risks associated with different sexual activities.
4. How to talk condoms with your (reluctant) man.	4. Interactive activity to align "condom excuses" with appropriate responses.
5. WiLLOW quiz show (review of first three activities in session 3).	5. WiLLOW Jeopardy game, with African-American game show host, in which viewer selects question categories, points. Both correct and incorrect answers provide information related to the correct responses.
6. Condom management: doing it right, dos & don'ts of condom use; practice makes perfect.	6. Health educator demonstrates four steps to proper condom use using penis model. Video of African-American women practicing and coaching one another on proper condom use.
7. Doing it in the dark: condom practice blindfolded.	
8. Safe sex is hot sex; alcohol & sex: not a good mix.	
9. Learning from each other: sharing stories about using condoms consistently.	7. "Safe sex stories" videos clip of women discussing importance and benefits of consistent condom use.
10. Goal setting	
Session 4: Building healthy relationships & it's your turn	
1. Introduction and review	
2. What do healthy relationships look like?	8. Presentation with visuals and audio on qualities of healthy and unhealthy relationships.
3. Is this a healthy relationship? What does abuse look like?	9. True/false quiz on qualities of healthy and unhealthy relationships.
4. The Power Pie	10. Mouse-over activity explores the power pie for abusive relationships; thought questions with screen freeze for reflection.
5. Talk or walk: breaking up is hard to do	11. Narration with visuals on warning signs of relationship violence and getting help in violent situations.
6. Session review	12. Review and closure.

WiLLOW implementation team. In keeping with the peer support dynamic of the original WiLLOW program, a skilled female African-American narrator guides the computer-delivered intervention. Using this content, the team programmed each module using Adobe Creative Suite/Adobe Flash and its scripting language, Action Script 3. Each WiLLOW module is available to users as an integrated part of the program and as a repeatable stand-alone module to allow for self-paced learning and reinforcement.

Study Aims

In the randomized controlled efficacy trial of the original WiLLOW program, women in the WiLLOW condition at a 12-month follow-up reported fewer episodes of unprotected vaginal intercourse (1.8 vs. 2.5; $p = .022$); were less likely to report never using condoms (odds ratio [OR] = .27; $p = .008$); and had greater HIV knowledge and condom-use self-efficacy [10]. The present study aimed to determine whether a multimedia version of the program could obtain similarly positive risk reduction results. Specifically, we hypothesized that, relative to the control condition, women in the Multimedia WiLLOW condition at follow-up would report (1) fewer episodes of unprotected vaginal or anal sex; (2) an increase in the percentage of condom use during vaginal and anal sex acts with both HIV-negative and HIV-positive partners; and (3) a greater number of participants reporting 100 % condom use for vaginal and anal sex. We further hypothesized that, relative to the control condition, women in the Multimedia WiLLOW condition would report improvements in psychosocial mediators and factors theorized to be linked to risk reduction behaviors, such as stress, self-esteem, social support, condom self-efficacy, and partner communication behaviors and skills. These findings would provide support for the efficacy of Multimedia WiLLOW and offer organizations a cost-effective and easily implementable, evidence-based HIV program that could expand HIV-positive, African-American women's access to needed HIV prevention services.

Methods

Procedures

The study employed a randomized controlled design conducted through a health department (two sites) and a community-based AIDS service organization (four sites)

which provide services to HIV-positive African-American women in a southern state with high HIV prevalence. To be eligible to participate women were required to be HIV-positive, African-American, English speaking and between the ages of 18 and 50. Because neither WiLLOW nor Multimedia WiLLOW discusses injection drug related risks in any detail and HIV-positive injection drug users may have different HIV prevention needs than non-injection drug users, eligible participants were also required to not have reported injecting any illicit drug in the past 12 months. The Institutional Review Boards at Sociometrics and the health department research site, and the executive directors of the community-based research site (which does not have an IRB), approved all study procedures, including incentive amounts.

Study staff at the recruitment sites received a full day, face-to-face training on study procedures and human subject protections and completed the NIH human subject protections online training. During May to July 2011, case workers and other health-care professionals working with HIV-positive African-American women at all six sites recruited eligible participants by verbally describing the study and handing out recruitment flyers. The flyer provided a brief overview of the study, participant expectations, and an invitation to call study recruiters to enroll in the study. Upon participant-initiated contact, study recruiters at each site scheduled eligible women for their first session, at which time they were directed to a private room and provided their written informed consent. Prior to enrollment, a randomization scheme was created using computer-generated block randomization in which participants were assigned to either Multimedia WiLLOW (intervention condition) or an HIV prevention brochures review (standard of care control condition) via sealed opaque envelopes using a 1:1 intervention-to-comparison randomization allocation. Study recruiters and coordinators were blinded to which condition (intervention or control) the participant had been assigned until they opened the envelope at the start of the participant's designated timeslot.

Once randomized into either the intervention or control arm, all participants completed a baseline assessment, watched Multimedia WiLLOW (intervention condition) or reviewed HIV education brochures for people living with HIV (control condition) individually in a private room, and completed a ten minute exit assessment addressing their impressions of their respective study condition. All assessments and study conditions were written at eighth-grade level reading levels. The control condition approximated the standard of HIV prevention care at the sites, in which case workers focus on the most immediate issues facing their HIV-positive clients (e.g., income, violence, incarceration, and child custody) and typically limit HIV prevention services to brief discussion and material distribution. On average women completed Multimedia WiLLOW in two hours and the brochures review in one hour.

Of 261 women initially recruited, 175 (67 %) were determined to be eligible and consented to participate in the study (see Fig. 1). Three months later, participants returned for the follow-up assessment. Retention rates for both conditions were high with 93.1 % ($N = 81$) in the intervention condition and 98.9 % ($N = 87$) in the control condition completing the follow-up. Participants received $75 for completing the first session and $50 for completing the follow-up assessment.

Measures

Data collection occurred at baseline and at a three-month follow-up via pen and paper. The baseline and follow-up assessments were identical and assessed sociodemographic characteristics, psychosocial mediators, HIV/AIDS prevention knowledge, and alcohol and substance use in past 30 days. Sexual behavior questions included total number of partners by HIV status (i.e. positive, negative, unknown) in the past 90 days; vaginal and anal sex with and without

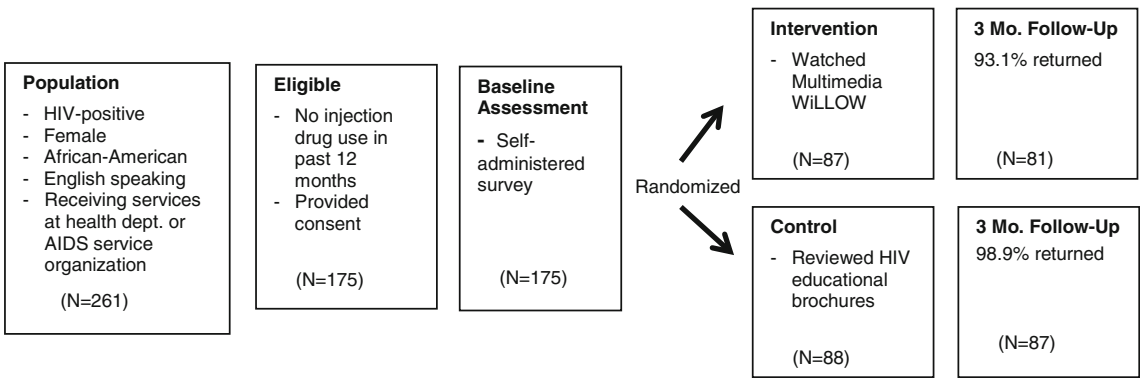

Fig. 1 Recruitment, allocation and retention of study participants

condoms in the past 30 days, by partner HIV status and relationship type (i.e. primary or non-primary); and condom use and substance use at last vaginal or anal sex event in the past 30 days.

Behavioral Outcomes

The primary behavioral outcomes were (1) percentage of condom protected vaginal and anal intercourse, and (2) 100 % condom use for vaginal and anal sex. Condom use frequencies were calculated based on self-reported sexual behavior in the past 30 days, as collected in the baseline and three month follow-up assessments. Behavioral outcomes were analyzed for all vaginal and anal sex partners, as well as disaggregated by partner HIV status and relationship type.

Psychosocial Mediators

Psychosocial mediators were derived from the intervention's underlying theoretical framework and a review of the literature on African-American women and HIV, with the goal of capturing potential changes in mental health and social support linked to HIV risk reduction practices. All constructs, excepting the condom use self-efficacy scale (see below), were assessed using scales with satisfactory psychometric properties developed in previous evaluations of face-to-face and computer-delivered versions of the SISTA/SiHLE/WiLLOW trilogy [8–10, 32, 33].

Knowledge and Condom Use Self-Efficacy

HIV transmission risk knowledge was measured using nine true/false questions, with high scores indicating greater knowledge. Condom use self-efficacy ($\alpha = .90$) was assessed using the condom use self-efficacy scale (CUSES), a 28-item validated instrument that has been extensively used in HIV prevention behavioral studies [34]. Higher scores indicate greater self-efficacy in using condoms correctly.

Partner Communication and Mental Health

An 8-item partner communication scale ($\alpha = .80$) assessed women's ability to negotiate safe sexual practices with their partners, with higher scores indicating greater partner communication efficacy. A 4-item scale addressed women's actual sexual communication behaviors with their partners, with higher scores indicating more communication on HIV risk reduction practices ($\alpha = .60$). General mental health variables shown in the literature to affect women's safer sex practices were assessed using a 14-item stress scale ($\alpha = .84$); a 10-item self-esteem scale ($\alpha = .80$); and an 18-item coping scale ($\alpha = .70$).

Social Support

Twenty-three questions addressed social support HIV-positive women may receive from family, friends, and clinic staff (e.g., doctors, nurses, or social workers) in five domains—practical (six questions), emotional (five questions), decision-making (five questions), HIV-related support (six questions) and overall (one question). Items included yes/no questions that addressed specific forms of social support (e.g. "If you had some questions about your health, like what you should eat or what medications you should take, is there someone who could give you some information?"; "If you had to be hospitalized for a few days because of your HIV-related illness, is there someone who would help you?"; "Is there someone who really understands you, your feelings, and what your life is like?"). Likert-scale questions addressed the frequency with which different types of social support were needed and received, with respondents also indicating the number of people who provided each type of social support.

User Satisfaction

Participants completed a 23-item user satisfaction survey immediately after viewing Multimedia WiLLOW (intervention) or reading the HIV educational pamphlets (control). The user satisfaction included Likert-like scale questions on program quality (i.e. overall design, ease of use, usefulness of information, potential to help people lower their sexual health risks) and experience with the program or brochures (e.g., enjoyment, held attention, clarity of presentation, interactivity and length of activities [intervention arm only]). Open-ended questions addressed overall impressions, likes and dislikes, new information learned and suggestions for improving the program or brochures.

Statistical Analyses

At baseline, descriptive statistics were calculated for sociodemographic variables, mediators and sexual behaviors (see Table 2). Differences between conditions were assessed using t tests for continuous variables and χ^2 for dichotomous variables [35]. Linear regressions and logistic regressions were used to assess HIV intervention effects at the 3-month follow-up. These models included a time-independent variable (study condition) and time-dependent variables (covariates and outcomes). Variables for which differences between study conditions were statistically significant (approaching the $p < .05$ level) were included as covariates in the models. Following the data analysis plan for the original WiLLOW intervention study, estimates were adjusted for the corresponding baseline

Table 2 Comparability of the Multimedia WiLLOW intervention and the control comparison groups

Characteristic	WiLLOW intervention ($n = 87$)		Control comparison ($n = 88$)		P	Test statistic[a]
	Mean (SD)	Percent (%)	Mean (SD)	Percent (%)		
Sociodemographic						
Age	39.5 (9.3)		41.8 (8.0)		.09	−1.71
High school education or less		65.4		64.0	.62	6.24
Not married/no long-term partner		89.9		80.5	.22	7.03
# of children	2.3 (1.8)		2.6 (1.8)		.18	−1.36
Live alone or self + children		48.2		48.4	.41	7.20
Income less than $12,000/year		66.7		70.2	.31	8.31
Not employed		80.2		72.4	.29	2.46
Have health insurance		66.7		64.4	.74	.61
Year of HIV diagnosis	2000 (7.4)		2000 (7.6)		.94	−.07
Psychosocial mediators						
Stress (range, 14–70)	37.1 (13.1)		36.3 (11.4)		.67	.42
Coping (range, 18–90)	59.9 (8.6)		62.6 (9.5)		.09	−1.71
Self-esteem (range, 10–50)	39.2 (7.8)		38.6 (7.4)		.65	.46
HIV transmission risk knowledge (range, 0–9)	8.0 (.93)		7.8 (1.2)		.17	1.38
Condom use self-efficacy (range, 27–135)	119.1 (14.0)		117.9 (17.3)		.65	.46
Communication self-efficacy (range, 8–40)	32.9 (6.0)		34.6 (5.9)		.08	−1.77
Structural factors						
Having someone to confide in about HIV		70.4		85.5	.02	5.27
Overall social support (1–5)	3.4 (1.3)		3.5 (1.2)		.38	−.88
Sexual and communication behaviors						
Had sex with steady partner, past 3 months		55.6		55.8		
Had sex with casual partner, past 3 months		18.1		21.9		
Number of sex partners, past 3 months	.96 (.72)		1.6 (6.5)		.39	−.87
Number of HIV-negative sex partners, past 3 months	.56 (.59)		.35 (.53)		.02	2.33
# times vaginal or anal sex with condoms with steady partner past 30 days	2.8 (4.4)		5.6 (8.0)		.06	−1.90
Number unprotected vaginal and anal intercourse	1.4 (2.7)		1.3 (3.4)			
In past 30 days					.92	.10
Sexual communication behaviors (scale, 4–16)	10.8 (1.7)		11.1 (1.6)		.28	−1.08

[a] Test statistics listed consist of t for continuous variables and χ^2 for categorical variables

measures for each outcome and other covariates in the model to obtain (1) adjusted mean differences to assess the effect of the intervention on continuous variables and (2) adjusted odds ratios (ORs) to assess the effect of the intervention on dichotomous variables. The 95 % confidence intervals (CIs) and corresponding p values were also computed. Percentage of relative change for continuous variables was computed as the difference between the adjusted means for intervention and control conditions divided by the adjusted mean for the control condition. Percentage of relative change provides a common measure of the magnitude of change across the different scale measures relative to the baseline measure and facilitates comparison between the outcomes of the original and multimedia versions of WiLLOW [10]. Analyses were made using SPSS Statistics 20.

Results

Participants

In total, 175 HIV-positive African-American women provided written informed consent and enrolled in the study. Eighty-seven (49.7 %) were randomly assigned to the computer-delivered WiLLOW condition, and 88 (50.3 %) to the HIV education brochure control condition. No differences in baseline sociodemographic characteristics were

Table 3 Effects of HIV intervention on self-reported condom use and related psychosocial condom use mediators 3-month assessment

	Unadjusted mean (SD)		Adjusted[a] Mean difference (d) or odds ratio (95 CI %)[b]	% Relative change[c] (95 % CI)	Test statistic[c]	*P*
	I	C				
Sexual behavior						
Prop. condom use, vaginal/anal sex, past 30 days, all partners	.89 (.30)	.73 (.42)	.33 (.13, .52)	45.21 (17.67, 71.36)	11.76	.002
Prop. condom use, vaginal/anal sex past 30 days, HIV-negative partners	.89 (.29)	.79 (.43)	.31 (.02, .61)	39.24 (1.14, 88.72)	4.83	.040
Prop. condom use, vaginal/anal sex, past 30 days, HIV-positive partners	1.0 (0)	.72 (.39)	.48 (.20, .75)	66.67 (27.98, 104.91)	14.89	.003
# unprotected vaginal/anal sex past 30 days	.24 (.54)	3.00 (6.18)	−3.41 (−5.54, −1.29)	−133.67 (−190.20, −41.71)	10.58	.002
100 % condom use, vaginal/anal sex, past 30 days	90.6	50.0	9.67[b] (1.25, 74.97)	na	9.67	.030
Partner Communication (sexual)						
Sexual communication scale	11.49 (1.29)	11.0 (1.56)	.60 (.00, 1.20)	5.45 (.00, 9.71)	3.94	.051
Psychosocial Mediators						
Communication self−efficacy scale	36.11 (3.97)	35.03 (5.92)	3.40 (1.12, 5.65)	9.70 (2.08, 21.77)	9.11	.004
Stress scale	31.69 (10.75)	35.77 (10.26)	−4.32 (−7.64, −.99)	−12.08 (−13.72, −3.76)	6.76	.012

[a] Adjusted by covariates: corresponding baseline variable, having someone to confide in about HIV, number of HIV negative sex partners in past 3 months, number of times used condoms with steady partners for vaginal/anal sex past 30 days

[b] Adjusted odds ratio calculated with the comparison condition as the referent (OR = 1.0)

[c] % Relative change (RC) = [D/C × 100 %] and 95 % Confidence Interval around the % relative change

[d] Test statistics listed consist of *F* for continuous variables and Exp(*B*) for categorical variables

observed between participants retained in the trial compared with those unavailable for the follow-up assessment.

At baseline, participants had an average age of 40.7 years (SD = 8.5) and had been living with HIV for an average of 11.3 years (SD = 7.4 years), with 12.5 % having received their HIV diagnosis within the past two years. Eighty-five percent had at least one child ($M = 2.4$ children), and most were single (63.0 %) or divorced/separated (18.5 %). Over one-third (36.9 %) of participants had not completed high school, while 26.2 % had a high school diploma, 16.7 % had completed some college, and 8.9 % had a vocational degree. Three-quarters did not work, and most women reported incomes below the poverty level (38.7 % reported incomes of less than $6,000 per year, 29.8 %; $6,001–12,000/year; and 10.7 % $23,001–$45,000/year).

On average, participants described themselves as having good to very good overall health on a 5-point Likert-like scale ($M = 3.39$, where 1 = poor, 3 = good, 5 = excellent). Almost half (45.8 %) reported being limited by a major health impairment, with HIV topping the list (32 %), followed by walking troubles (22 %), depression (21.4 %), back/neck pain (20.2 %), eye/vision problems (19.6 %) and hypertension (18.5 %). On average, participants reported 6.5 days/month in which their health was not good; 9.7 days/months when their mental health was not good; 9.8 days/months of feeling depressed; 10.8 days/month of feeling anxious; and 12.7 days/months of not getting enough rest.

Ninety-five percent of participants had disclosed their HIV status to another person, most often their social worker (58.9 %), sister (53.0 %), mother (51.8 %), brother (50.6 %) or daughter (42.3 %). Participants reported less frequent disclosure to their sons (35.7 %) or fathers (26.8 %). The average time from discovering their HIV status to disclosing for the first time was 6 months, with most women (58.3 %) disclosing within less than a month of finding out they were HIV-positive. The most commonly reported substances used in the past month were alcohol (42.9 % of participants, $M = 6.2$ days used and $M = 2.7$ drinks per day), marijuana (13.7 % of participants, $M = 14.1$ days used and $M = 5.0$ times per day), and crack cocaine (4.2 % percent of participants, $M = 9.3$ days used and $M = 3.7$ times per day).

Statistically significant differences (approaching the $p < .05$ level) between the intervention and control conditions were observed for the number of HIV-negative partners, the number of vaginal or anal sex acts with

condoms with primary partners, and having someone to confide in about being HIV-positive (see Table 2). These three variables were included as covariates in the linear regression and logistic regression analyses. No other significant differences at baseline were observed for the sociodemographic characteristics and the remaining mediators and outcome measures.

Effects of the Intervention on Sexual Behaviors

Multimedia WiLLOW participants had a significantly higher proportion of condom protected vaginal and anal sex acts in the past 30 days (adjusted mean difference = .33, $F = 11.57$; $p = .002$) (see Table 3; Fig. 2). This higher condom use occurred with both HIV-negative (mean difference = .31, $F = 4.83$; $p = .04$) and HIV-positive (mean difference = .48, $F = 14.89$; $p = .003$) partners. Women receiving Multimedia WiLLOW were also more likely to report 100 % condom use (OR 9.67, 95 % CI 1.25–74.97; $p = .03$), and had a lower adjusted mean number of unprotected vaginal and anal sex acts in the past 30 days (mean difference = −3.41, $F = 10.58$; $p = .002$).

Effects of the Intervention on Psychosocial Mediators

In comparison to women in the control condition, Multimedia WiLLOW participants reported significantly greater sexual communication self-efficacy (mean difference = 3.40, $F = 9.12$; $p = .004$), and less stress (mean difference = −4.32, $F = 6.76$; $p = .01$), and communication with partners on HIV risk reduction practices approached significance (mean difference = .60, $F = 3.94$, $p = .05$). There were no significant differences between the intervention and control conditions on condom self-efficacy, HIV prevention knowledge, coping, self-esteem, control of life, or social support variables.

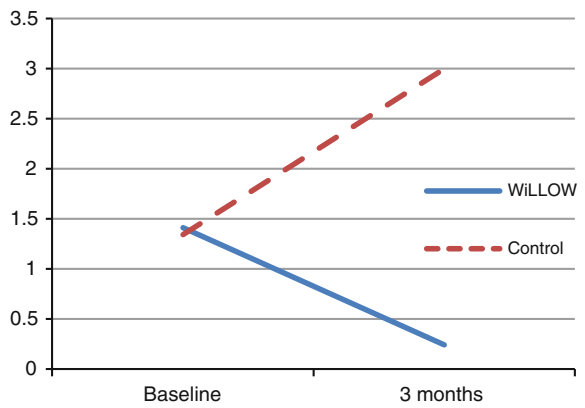

Fig. 2 Intervention effects on number of unprotected vaginal and anal sex acts (past 30 days) adjusted mean number of unprotected vaginal and anal sex in past 30 days

User Satisfaction

Participants rated the computer-delivered intervention more favorably than the HIV education brochure control on a 1–5 Likert-type scale in the four principal satisfaction categories—enjoyment (4.69 vs. 4.26, $t = 3.66$, $p < .001$), information utility (4.76 vs. 4.56, $t = 2.40$; $p = .02$), information clarity (4.81 vs. 4.58, $t = 2.17$; $p = .02$) and held attention (4.68 vs. 4.41, $t = 2.613$; $p = .01$). More Multimedia WiLLOW than control participants also reported having learned something new (96.6 % vs. 74.8 %, $\chi^2 = 43.42$; $p < .001$) and thinking that other African-American women would be interested in the prevention education they received (6.43 vs. 5.92 on a 1–7 Likert-like scale, $t = 2.45$; $p = .02$).

Discussion

This is the first study to demonstrate that a computer-delivered intervention can reduce HIV transmission risks and enhance psychosocial mediators associated with HIV preventative behaviors among African-American women living with HIV. The findings add to a growing literature demonstrating the efficacy of computer-delivered HIV prevention programs in reducing sexual health risks in diverse populations [23]. The fact that the intervention demonstrated increases in condom use with both HIV-negative and HIV-positive partners suggests that the program can help decrease new HIV infections and HIV re-infection, as well as sexually transmitted infections more generally. The findings of increased 100 % percent condom use and proportion of condom-protected sex acts are also noteworthy because most of the sexually active participants in the study described themselves as being in a committed relationship with their partners, which has been shown to be a barrier for women trying to implement safer sex practices [29, 30, 32, 33].

Women in the intervention condition in the Multimedia WiLLOW study reported a greater reduction in the number of adjusted unprotected sex acts (3.4) than their counterparts in the original WiLLOW study (1.3). Given the shorter follow-up period in this study (3-months) compared to the original WiLLOW trial (6-months and 12-months), it is likely that that this difference in effects size is exaggerated, as intervention effects typically reduce over time. In contrast to the original WiLLOW study, we did not observe improvements in social support, nor did we find improvements in self-esteem or coping.[1] These results are not surprising given the different formats of the two programs—a

[1] The original WiLLOW study data collection instrument included coping, stress and self-esteem scales, but these variables were not reported in the publication of study findings.

four session, 16-h group level intervention delivered over a month provides far greater opportunity to develop social support and affect psychosocial mediators than a 2-h, computer-delivered program viewed individually in a private room. Nonetheless, women receiving Multimedia WiLLOW did report improvements in stress reduction and communication skills, suggesting that computer-delivered programs may successfully model these behaviors. Providers who seek to raise social support among their clients might elect to supplement Multimedia WiLLOW with face-to-face group activities or if resources are available, implement the original face-to-face WiLLOW program.

The intervention's efficacy may derive from its modeling of gender empowerment and effective communication, as demonstrated by the increase in partner communication self-efficacy and reductions in stress among Multimedia WiLLOW participants. The efficacy may also be attributable to the intervention's gender-tailored content that directly addresses the structural and psychosocial factors that affect the ability of women living with HIV to practice safer sex and lead healthy lives. The relevance of the intervention's gender/ethnic pride framework is supported by the finding that women in both the intervention and control conditions were more likely to have disclosed their HIV status to female than male relatives, suggesting that these female social support networks can play an important role in promoting healthy behaviors and HIV/STI risk reduction among African-American women living with HIV. The appropriateness of this broad HIV prevention approach was further confirmed in the user satisfaction survey, with participants strongly agreeing Multimedia WiLLOW would be of interest to other African-American women living with HIV and would help them lower their sexual health risks.

Implementing Multimedia WiLLOW program requires relatively few resources[2] and minimal staff training. Providers can offer the program to HIV-positive African-American women on an impromptu basis when they are receiving health or social services, or integrate Multimedia WiLLOW into structured HIV support services. Clients/patients can also review the entire program periodically as a booster or watch segments that address important prevention issues (e.g. sexual communication, re-infection and social support) that emerge in course of service delivery. With its focus on social support, Multimedia WiLLOW may lead some participants to seek other HIV prevention or treatment adherence interventions and/or be motivated to provide peer support to other women living with HIV.

This study is not without its limitations. First, the findings may not be applicable to women with different risk profiles, such as those injecting illicit drugs who are not represented in the study. The sociodemographic variables represented within our sample are reflective of the populations served by the study sites and the target audience for the multimedia WiLLOW program. And although the study's population represents the neediest population in terms of HIV prevention and other social services, further research with a wider sample of HIV+African-American women would allow for a deeper understanding for how Multimedia WiLLOW may support women of all economic backgrounds (e.g. middle class), age ranges (e.g. young adult) and different risk profiles (injection drug use). A second concern is the reliance on self-reported data for the primary outcome measure, though prior research has established the validity and reliability of self-reported data [36]. A third limitation is the relatively short three month follow-up. Another limitation is that our findings cannot be directly compared to those from the efficacy trial for the original WiLLOW program, since the present study was not designed to make such comparisons.

Conclusion

Computer-delivered interventions such as Multimedia WiLLOW offer an effective, cost-efficient, engaging and scalable method to take the content of proven group level interventions to at-risk populations in multiple settings, including clinics, community and faith-based organizations, correctional facilities and private residences. With the new national focus on "High Impact Prevention" (HIP) [37], Multimedia WiLLOW could be utilized with populations in need of maximized prevention efforts, such as HIV-positive African-American women. Given the efficacy and accessibility of computer-delivered interventions, more of these culturally tailored programs should be developed to ensure that other vulnerable populations continue to receive effective HIV/STI prevention education in our current budgetary challenged times.

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[2] Multimedia WiLLOW may be purchased through the Sociometrics website, www.socio.com

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