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ORIGINAL PAPER

A Pilot Intervention Trial to Promote Sexual Health and Stress Management Among HIV-Infected Men Who Have Sex with Men

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Abstract
Men who have sex with men (MSM) experience HIV disparities. This study pilot-tested a two session, group-delivered intervention to promote sexual health and stress management skills for HIV-infected MSM. Participants ($N=80$) were randomized to an immediate or delayed intervention condition. Analyses of covariance examined intervention efficacy. Compared to the delayed condition, intervention condition participants reported: greater HIV transmission knowledge ($p<.001$), higher HIV disclosure self-efficacy ($p=.004$), stronger intentions to refuse unprotected sex ($p=.05$), decreased frequency of unprotected anal or oral sex ($p=.03$), decreased perceived stress levels ($p=.03$), and higher coping self-efficacy ($p=.003$). Differences in the number of unprotected anal sex episodes, condom attitudes, and level of social support did not differ between conditions. Findings provide evidence of intervention acceptability and suggest the brief intervention may enhance stress management skills and modify sexual risk behavior antecedents for HIV-infected MSM.

Keywords HIV prevention intervention · HIV-infected individuals · Men who have sex with men (MSM) · Sexual risk reduction intervention · Stress management

Introduction

Despite an increasing number of biomedical and behavioral HIV prevention options, there were 44,073 incident HIV infections in the United States (US) in 2014 [1]. Men who have sex with men (MSM) continue to experience the greatest HIV disparities in the US. MSM represent 2% of the US population, yet comprise 55% of individuals living with HIV [2]. In 2014, MSM accounted for 83% of incident HIV infections among men and 67% of all new diagnoses in the US [2].

Biomedical HIV prevention approaches including pre-exposure prophylaxis (PrEP) use of antiretroviral (ARV) medications or "treatment as prevention" approaches to increase HIV treatment engagement and ARV adherence offer promise to curb new incident HIV infections among MSM [3]. However, the efficacy of such biomedical approaches will likely be bolstered when used in combination with evidence-based behavioral HIV prevention interventions [4, 5]. Thus, the development and dissemination of efficacious secondary HIV prevention interventions to reduce sexual risk behavior among HIV-infected individuals, particularly MSM, remains an important public health priority [6–9].

Whereas meta-analyses suggest that sexual risk reduction interventions for HIV-infected individuals are efficacious [8, 10–12], findings for sexual risk reduction interventions involving HIV-infected MSM have shown mixed success [13–18]. For example, findings from the Seropositive Urban Men's Intervention Trial, the first major intervention trial to focus exclusively on HIV-infected MSM, found no effect for a group-based program on rates

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of unprotected sex [19]. More recently, the Positive Connections trial for HIV-infected MSM found no differences between a tailored health seminar intervention and video-delivered comparison condition on frequency of serodiscordant unprotected anal sex [15]. Thus, there continues to be a need to develop efficacious interventions tailored to HIV-infected MSM to promote sexual health.

Interest in participating in interventions that focus exclusively on sexual behavior change and HIV risk reduction, especially among HIV-infected MSM, is relatively low [20]. Instead, interventions that address a broader set of needs related to mental and physical health interest HIV-infected MSM more [21–23]. Intensive interventions that target more than one condition (e.g., mental health problems, antiretroviral medication adherence challenges) have generally been shown to be more effective in reducing sexual risk behaviors compared to interventions that target only one condition [9, 11]. For example, Parsons and colleagues developed and pilot-tested a 10-session intervention to enhance emotion regulation skills among HIV-infected gay and bisexual men and found decreased sexual risk behavior, substance use, and improvement on psychological outcomes (e.g., depressive symptom levels; [24]).

A significant proportion of HIV-infected people report difficulties in coping with HIV and other stressors, prompting greater psychological distress and undermining quality of life [25–28]. Co-morbid psychiatric disorders and substance use are highly prevalent among HIV-infected individuals [29]. Although HIV shares some common features with other chronic illnesses, HIV disease poses a number of unique coping challenges that heighten patients' vulnerability to psychological adjustment difficulties [30–32]. HIV-infected MSM may experience stigma associated with both sexual minority status and HIV serostatus [33]. Thus, an empirically-based intervention approach with a combined focus on coping with sexual minority status, HIV-related stressors, and sexual health may offer more promise than a stand-alone intervention focusing exclusively on sexual risk reduction.

Building on our qualitative research [20], we sought to develop an appealing intervention that addressed the combined stress management and health behavior challenges faced by HIV-infected MSM. Informed by Coping Effectiveness Training [34, 35] and the Information Motivation Behavioral Skills Model [36, 37], our intervention integrated content designed to improve stress management and coping skills while also addressing key motivational and skills-based barriers to sexual risk reduction. In this study, we report initial data on the feasibility, acceptability, and efficacy of our new intervention.

Methods

Participants

Eighty HIV-infected MSM receiving outpatient HIV care at an academic medical center provided consent, completed the initial baseline questionnaire, and were randomized to study conditions.

Procedures

Participant Recruitment and Study Eligibility

Male patients were recruited during outpatient HIV medical visits at a University-based Infectious Disease Clinic in a medium-sized Northeastern US city. Staff described the study to male patients with past sexual experiences involving other men during their regularly scheduled medical appointments. Patients were eligible to participate if they were: (a) male; (b) HIV-infected; (c) reported having oral or anal sex with a man during the past year; (d) medically, cognitively, and psychologically capable of participation (as determined by clinic staff); and (e) able to read and converse in English. Figure 1 provides the CONSORT diagram for participant recruitment and retention. All participants provided informed consent to participate and received $20 for each assessment and $20 for each intervention session they completed for time and transportation costs. Additionally, participants received $5 for attending additional support group sessions. The study was approved by the Institutional Review Boards at the participating institutions.

Experimental Design

Figure 1 depicts the study's design and assessment time points. Participants were randomly assigned to an immediate intervention condition ($n = 40$) or a time delayed intervention control condition ($n = 40$). Those in the immediate treatment condition completed: (a) a pre-intervention assessment (Time 1); (b) the two intervention sessions; (c) a post-assessment survey immediately following the intervention (Time 2); and (d) a 3-month follow-up assessment following the intervention (Time 3). Participants randomized to the delayed treatment condition completed: (a) an initial pre-intervention assessment (Time 1); (b) a second pre-intervention assessment that was time matched to when the immediate intervention participants completed their 3-month assessment (Time 3); (c) the two intervention sessions; (d) a post-assessment survey immediately

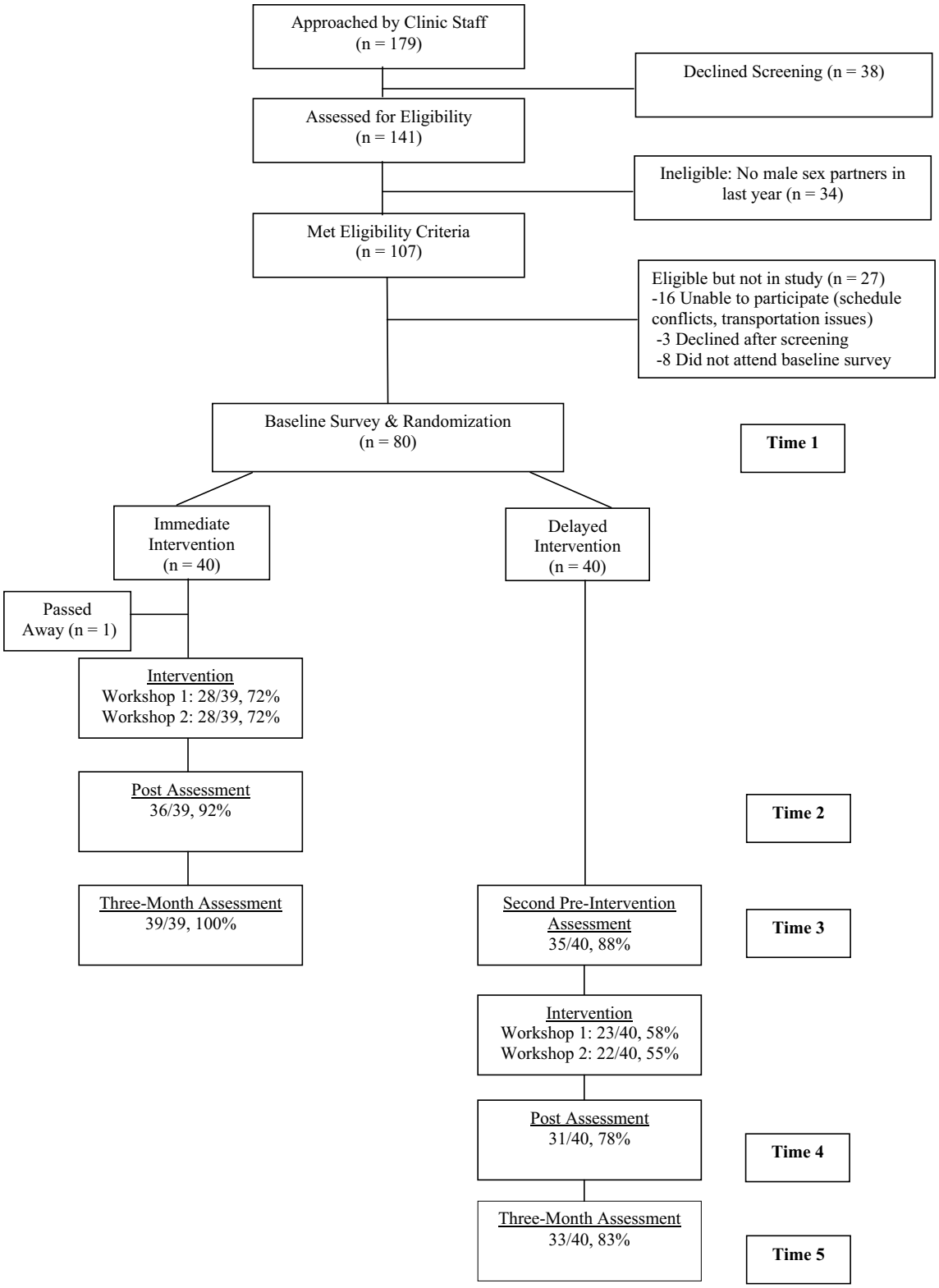

Fig. 1 CONSORT diagram for participant recruitment and retention that illustrates experimental design and time points used in analyses to evaluate the intervention's efficacy

following the intervention (Time 4); and (d) a 3-month follow-up assessment (Time 5).

Overview of Intervention

Grounded in behavioral science theory and informed by our formative, qualitative research [20], the intervention included two group sessions that addressed motivational, behavioral skills, and HIV transmission information tailored to HIV-infected MSM coupled with stress management training. An overview of content covered in each of the two intervention sessions is provided in Table 1. A copy of the intervention manual is available from the second author. Intervention sessions were led by two MSM facilitators who had prior work experience in HIV risk reduction counseling and in addressing psychosocial aspects of HIV. Each intervention session was approximately 4 h long. Groups were comprised of approximately ten participants. Attendance rates for each of the workshop sessions can be found in Fig. 1. After completing the intervention workshops, all men were invited to participate in supportive group sessions ("Poz Talk") led by the intervention facilitators. These groups were approximately 2 h long and served both as a supportive forum for the participants and to reinforce stress management and sexual risk reduction strategies covered by the intervention.

Measures

Background Characteristics and Self-Reported HIV Health Status

Participants reported their race, age, current employment status (yes/no), number of hours worked (if currently employed), and monthly income. For descriptive purposes, respondents reported their current relationship status by

Table 1 Overview of intervention goals and material covered in each session

Session 1: Program overview, focus on healthy living, coping effectiveness training, and stress management	
Session goals:	Session content (corresponding length):
(1) Orient group members to the purpose and goals of the program (2) Build rapport among group members (3) Provide latest information on HIV epidemiology and HIV treatment among MSM (4) Establish motivational foundation: health behavior and coping critical to sustained health (5) Learn skills to manage the stress of being HIV-infected (6) Introduce coping effectiveness framework (7) Identify core strategies for problem and emotion focused coping (8) Address challenges associated with social support and disclosure (9) Identify and develop inventory of social support (10) Applying problem solving approach	(1) Welcome and introductions (15 min): -Overview of program goals and ground rules -Introductions and personal narratives: living with HIV (2) ARV-healthy/AIDS optimism picture activity (15 min) (3) HIV in our community (30 min): -Maintaining our health and contemplating your role in the community -Setting the stage for change: successes and Challenges of staying healthy and helping your community (30 min) (4) Break (15 min) (5) Intro to coping effectiveness and stress management (40 min): -Stress and living with HIV -Managing stress (30 min) -Bringing it all together (10 min) (6) Support from others (15 min) (7) Managing the stress of disclosure (40 min) (8) Preview of next session and wrap-up (10 min)
Session 2: Healthy relationships	
Session goals:	Session content (corresponding length):
(1) Increase comfort with condoms (2) Learn ways to preserve health and safety (3) Identify personal triggers and ways in which to manage them (4) Strengthen assertiveness and negotiation skills (5) Practice and know how to correctly use a condom while still making the experience enjoyable	(1) Welcome and group check in (2) Review of last session (3) Healthy relationships & intimacy (20 min) (4) Question and answer session: facts to live by (30 min) (5) Managing the risks: personal goals for sexual safety (30 min): -Risk continuum exercise (6) Facts alone aren't enough, Part I (15 min): -Self talk versus self-justification (7) Facts alone aren't enough, Part II (35 min): -Trigger management -Problem solving approaches (8) Negotiation (50 min): -Partner communication -Assertive statement skills -Fine tuning negotiation skills (9) Condom demonstration (20 min) (10) Wrap-up (15 min)

indicating whether they: (a) lived with a primary partner; (b) had a primary partner but lived separately; or (c) did not have a primary partner. Participants also reported: (a) whether they had a detectable viral load during their last medical visit (yes/no/don't know); (b) whether they had been previously hospitalized for an HIV-related illness (yes/no); and (c) whether they had been diagnosed with AIDS (yes/no).

HIV Transmission Knowledge

This 23-item measure assessed HIV knowledge, including factors that impact HIV transmission risk to uninfected partners [38]. Knowledge domains assessed correspond to core knowledge modules that were included in our sexual risk reduction curriculum. In particular, items assess knowledge regarding the impact of STD co-infections on HIV infectivity and disease progression, health risks related to unprotected sex involving two HIV-infected partners, the relationship of HIV viral load to infectivity, differences in HIV transmission risks associated with being the receptive or insertive partner for anal sex, and STD and HIV transmission risk associated with oral sex. The measure also includes items that assess knowledge of specific STDs that can affect the health of HIV-infected MSM. For each item, participants indicated whether the statement was "mostly true," "mostly false," or "don't know" for any items they were unsure of the correct response. A total score of correct responses was calculated; higher scores were indicative of greater HIV transmission knowledge.

Condom Attitudes

Using a five-item measure, participants indicated their attitudes towards condoms using a six-point Likert scale with response options ranging from "strongly disagree" to "strongly agree" [39]. Responses across items were summed; higher scores were indicative of more favorable condom attitudes ($\alpha = .74$).

Sexual Behavior Intentions

Participants reported their intentions to refuse unprotected sex using a single item adapted from Carey et al. [40]. Participants were asked to imagine that they had just met a new partner who they felt very attracted to and who wanted to have sex with them. Participants then indicated their intentions to refuse sex if the partner would not use a condom by selecting one of the following response options: "definitely no", "probably no", "probably yes", or "definitely yes." Higher scores were indicative of greater intentions to refuse unprotected sex.

Self-Efficacy for HIV Serostatus Disclosure

This 3-item measure assessed self-efficacy to disclose one's HIV serostatus to sexual partners in the next 3 months using a five-point Likert scale with response options ranging from "very hard to do" to "very easy to do" [41]. Responses across the three items were summed such that higher scores represented greater self-efficacy to disclose one's HIV serostatus to partners ($\alpha = .82$).

Unprotected Sexual Behaviors, Last 3 Months

This self-report measure [42] assessed the frequency that participants engaged in: (a) unprotected oral sex; and (b) unprotected anal sex during the past 3 months with both a steady partner and/or non-steady partners (e.g., "How many times did you give or receive oral sex without a condom?"). Counts of each behavior were summed across partner types.

Coping Self-Efficacy

The 15-item coping self-efficacy questionnaire assessed self-confidence in performing coping behaviors when faced with life challenges [43]. Participants rated their confidence to manage stressors using different coping strategies during the last month (e.g., "Get emotional support from friends and family") using a zero to ten rating scale, with lower ratings indicating less confidence. Responses were summed across items with higher scores indicating greater coping self-efficacy ($\alpha = .96$).

Perceived Stress

The 10-item Perceived Stress Scale measures the level of stress associated with everyday life [44]. This scale assessed the degree to which participants had experienced stress during the past month. Participants rated each item using a five-point Likert scale ("never", "almost never", "sometimes", "fairly often", "very often"). A summed score across items was calculated; higher scores represented greater perceived stress levels ($\alpha = .88$).

Social Support

The 18-item Social Provisions Scale assesses one's degree of social support [45]. For each item, participants indicated the extent to which each statement described their social network using a 4-point Likert scale ("strongly disagree", "disagree", "agree", "strongly agree"). A total score across

items was calculated such that higher scores were indicative of greater social support (α = .91).

Intervention Acceptability

Participants evaluated the acceptability and perceived efficacy of the intervention program on a measure designed for this study that was administered at the immediate post-assessment. Six items measured the degree to which participants enjoyed the intervention and found the information to be useful using a four-point Likert scale. Five additional questions assessed participants' satisfaction with the intervention facilitators. Higher values were indicative of greater satisfaction.

Analytic Approach

One participant passed away prior to the intervention sessions; all analyses utilize the reduced sample ($N = 79$). Missing values were imputed by carrying the last observation forward. For the sexual behavior outcomes, data points that were more than three standard deviations away from the mean were transformed such that the value was equivalent to a score of $z = 3$ [46]. In addition, the skewed sexual behavior distributions were also re-expressed using a transformation that best approximates a Gaussian distribution (i.e., formula $\log_{10}(x+1)$; [47]).

Descriptive statistics were calculated to characterize demographic characteristics, self-reported HIV health status variables, and baseline levels of the outcome measures for the full sample and by intervention condition. Chi square and univariate ANOVA analyses were used to examine equivalency between the two conditions on demographic characteristics, self-reported HIV health status variables, and baseline levels of the outcome measures. To examine intervention feasibility and acceptability, descriptive statistics characterized: (a) intervention session participation rates; (b) participants' intervention evaluation ratings; and (c) attendance of supplemental support group sessions. An independent samples *t* test compared the number of intervention sessions attended between study conditions.

Figure 1 graphically depicts the assessment time points utilized for the between subjects analyses conducted to evaluate the intervention's efficacy. A series of analyses of covariance (ANCOVAs) were conducted to examine if participants in the immediate treatment condition (who attended one or both of the intervention sessions) reported changes in 3-month assessment outcomes compared to the delayed treatment participants who had not yet received the intervention (Time 3), accounting for baseline levels of functioning (Time 1). For each ANCOVA, partial eta^2 was calculated as a measure of effect size.

Results

Participant Characteristics

Table 2 summarizes participants' sociodemographic characteristics and HIV status variables for the full sample and by condition. Approximately 63% of participants were Caucasian, 26% were African American, 1% were Asian, 1% were Native American, 8% were multiracial, and 1% identified as "other." Participants' ages ranged from 22 to 62 (M age = 40.6, $SD = 8.0$). Approximately half was currently employed (49%) working an average of 38.6 h a week ($SD = 13.7$); monthly income was low ($M = \$1167$, $SD = 1260$). With regard to relationship status, 33% were living with a primary partner, 14% had a primary partner but did not live together, and 53% did not have a primary partner. Nearly half (46%) reported having an undetectable viral load during their last medical appointment; 33% had been hospitalized with an HIV-related illness and 28% had been diagnosed with AIDS.

Equivalency Between Study Conditions

There were no differences on demographic characteristics or self-reported HIV health status variables between study conditions (see Table 2). Descriptive statistics regarding participants' baseline levels on each of the outcome measures are presented for the full sample and by study condition in Table 3. There were no baseline differences between study conditions on any of the outcome variables except condom attitudes (see Table 3); those in the immediate intervention group reported more favorable attitudes towards condoms than the delayed intervention group, $F(1, 78) = 5.9$, $p = .02$.

Intervention Feasibility and Acceptability

Intervention Session Participation

Sixty-five percent of participants attended the first workshop, 63% attended the second session, and 57% attended both workshop sessions. The number of intervention sessions attended did not differ between the immediate intervention ($M = 1.4$, $SD = .82$) and delayed intervention condition ($M = 1.1$, $SD = .94$), $t(77) = 1.57$, *ns*.

Intervention Session Evaluations

Participants rated their satisfaction with the intervention program and group facilitators using a four-point Likert scale with higher values indicating greater satisfaction. Overall, participants who attended one or both intervention sessions

Table 2 Comparison of baseline demographic and HIV medical status characteristics for the full sample and by intervention condition (N = 79)

Characteristic	Full sample (N = 79) *n* (%)	Immediate treatment condition (*n* = 39) *n* (%)	Delayed treatment condition (*n* = 40) *n* (%)	*F*	x^2	*p*
Sociodemographics						
Race[a]					5.7	.34
Caucasian	49 (62.8)	26 (66.7)	23 (59.0)			
African American	20 (25.6)	7 (17.9)	13 (33.3)			
Asian	1 (1.3)	1 (2.6)	0 (0)			
American Indian	1 (1.3)	0 (0)	1 (2.6)			
Multiracial	6 (7.7)	4 (10.3)	2 (5.1)			
Other	1 (1.3)	1 (2.6)	0 (0)			
Age (M, SD)	40.6 (8.0)	39.4 (8.1)	41.9 (7.8)	1.9		.16
Employment status					.32	.66
Not employed	40 (50.6)	21 (53.8)	19 (47.5)			
Employed	39 (49.4)	18 (46.2)	21 (52.5)			
Number of hours worked (M, SD)[b]	38.6 (13.7)	37.2 (15.1)	39.8 (12.6)	.33		.57
Monthly income (M, SD)	1167.1 (1260.5)	1156.8 (1399.4)	1177.4 (1122.9)	.005		.94
Current relationship status					.17	.92
Primary partner, live together	26 (32.9)	13 (33.3)	13 (32.5)			
Primary partner, live separately	11 (13.9)	6 (15.4)	5 (12.5)			
No primary partner	42 (53.2)	20 (51.3)	22 (55.0)			
HIV medical status						
Most recent viral load[c]					.59	.75
Undetectable (< 50 copies/mL)	35 (46.1)	17 (45.9)	18 (46.2)			
Detectable (> 50 copies/mL)	25 (32.9)	11 (29.7)	14 (35.9)			
Does not know most recent viral load	16 (21.1)	9 (24.3)	7 (17.9)			
Previous HIV-related hospitalization					.31	.64
No HIV-related hospitalization	53 (67.1)	25 (64.1)	28 (70.0)			
HIV-related hospitalization(s)	26 (32.9)	14 (35.9)	12 (30.0)			
Prior AIDS diagnosis					.87	.45
No prior AIDS diagnosis	57 (72.2)	30 (76.9)	27 (67.5)			
Prior AIDS diagnosis	22 (27.8)	9 (23.1)	13 (32.5)			

[a] *n* = 78 reporting

[b] *n* = 39 reporting

[c] *n* = 76 reporting

indicated a high level of comfort in the workshops (*M* = 3.8, *SD* = .51). Participants found the workshops to be interesting (*M* = 3.8, *SD* = .54) and would recommend the intervention to a friend (*M* = 3.8, *SD* = .52). Most participants were satisfied with the information provided in the groups (*M* = 3.8, *SD* = .58), believed the information to be important (*M* = 3.8, *SD* = .54), and felt that the intervention content met their needs (*M* = 3.4, *SD* = .65). Participants also expressed satisfaction with the group facilitators. Responses indicated that they found the facilitators to be friendly (*M* = 3.9, *SD* = .14), likeable (*M* = 3.9, *SD* = .23), helpful (*M* = 3.9, *SD* = .26), caring (*M* = 3.9, *SD* = .19), and knowledgeable (*M* = 3.9, *SD* = .19).

Participation in Supplemental Support Group Sessions

After completing the intervention, all participants were eligible to participate in additional support group sessions. Thirty-seven percent of the participants elected to attend one or more support group sessions.

Intervention Efficacy

To examine the impact of intervention attendance on key outcomes, between-subjects ANCOVAs were performed, limiting the immediate intervention condition to those attending at least one workshop. Descriptive statistics and

Table 3 Baseline levels on outcome measures for the full sample and by intervention condition (N = 79)

	Full sample ($N = 79$) M (SD)	Immediate treatment condition ($n = 39$) M (SD)	Delayed treatment condition ($n = 40$) M (SD)	F	p
Social cognitive determinants of sexual risk behaviors (possible range)					
HIV transmission knowledge (0–23)	11.6 (3.1)	11.1 (3.5)	12.2 (2.5)	2.3	.13
Condom attitudes (5–30)	22.9 (4.7)	24.2 (4.9)	21.7 (4.2)	5.9	.02
Intentions to refuse unprotected sex (1–4)	3.1 (.95)	3.1 (1.0)	3.2 (.90)	.21	.65
Self-efficacy to disclose HIV (3–15)	13.4 (5.6)	12.9 (6.4)	14.0 (4.8)	.72	.39
Sexual behaviors: past 3 months					
Unprotected anal sex	4.3 (11.7)	2.7 (5.2)	5.9 (15.4)	1.5	.23
Unprotected anal or oral sex	17.0 (34.4)	17.4 (37.9)	16.7 (31.0)	.007	.94
Psychosocial constructs					
Perceived stress (10–50)	28.1 (7.7)	29.2 (7.6)	27.1 (7.7)	1.4	.24
Social support (4–72)	57.4 (9.3)	58.2 (8.4)	56.6 (10.2)	.57	.45
Coping self-efficacy (0–150)	92.8 (33.3)	91.5 (32.2)	94.2 (34.6)	.13	.73

ANCOVA results are displayed in Table 4. Participants in the immediate group demonstrated greater: (a) HIV transmission knowledge; (b) intentions to refuse unprotected sex; and (c) self-efficacy to disclose their HIV serostatus to partners. For the sexual behavior outcomes, those in the immediate group reported fewer unprotected oral or anal sex encounters; however, there was no difference between conditions for frequency of unprotected anal sex in the past 3 months. For the psychological outcomes, participants in the immediate intervention condition reported: (a) greater coping self-efficacy; and (b) decreased perceived stress. There were no differences between conditions for condom attitudes or social support.

Discussion

With the improved long-term prognosis following an HIV diagnosis, interventions for MSM that address sexual health within the context of broader health promotion and stress management challenges continue to be needed. Findings from this pilot study provide initial evidence of intervention feasibility and acceptability and suggest that our brief

Table 4 Between-subjects' analyses examining intervention efficacy (N = 71)

	Time 3: M_{ADJ} (SE)		Test statistic	p	Effect size (η_p^2)
	Immediate treatment condition	Delayed treatment condition			
Social cognitive determinants of sexual risk behaviors					
HIV transmission knowledge	13.8 (.36)	11.7 (.31)	$F(1, 68) = 18.7$	<.001	.22
Condom attitudes	23.0 (.53)	23.2 (.46)	$F(1, 68) = .12$	.73	.002
Intentions to refuse unprotected sex	3.4 (.16)	3.0 (.14)	$F(1, 68) = 3.9$	.05	.06
Self-efficacy to disclose HIV status	15.7 (.82)	12.5 (.72)	$F(1, 68) = 8.7$	.004	.11
Sexual behaviors: past 3 months					
Unprotected anal sex	.18 (.05)	.27 (.05)	$F(1, 67) = 1.7$	.20	.02
Unprotected anal or oral sex	.51 (09)	.76 (.08)	$F(1, 67) = 4.7$	.03	.07
Psychosocial constructs					
Perceived stress	25.1 (1.0)	28.1 (.88)	$F(1, 68) = 5.0$	.03	.07
Social support	57.9 (.96)	56.4 (.85)	$F(1, 68) = 1.4$	.25	.02
Coping self-efficacy	105.8 (3.8)	90.1 (3.3)	$F(1, 68) = 9.6$	.003	.12

Values presented are adjusted means and standard errors at Time 3 accounting for Time 1 values. Sexual behavior data variables presented represent outlier truncated, transformed variables. The sample analyzed in the immediate intervention condition is limited to those attending at least one intervention session

intervention can be successful in modifying sexual risk behavior antecedents and enhancing stress management skills.

The intervention improved participants' knowledge of HIV transmission risk information and enhanced their self-confidence to disclose their HIV serostatus to partners. Research is needed to investigate whether HIV serostatus disclosure coupled with HIV transmission knowledge can help to address other HIV transmission risk behaviors beyond condom use (e.g., engaging in sex with only HIV-infected individuals, enhanced HIV testing, PrEP use; [48]). Intervention recipients also reported stronger intentions to refuse unprotected sex even though there were no changes in attitudes towards condoms. However, given the short follow-up assessment period, examination of the durability of study findings over longer periods of time is warranted. Further, rates of unprotected anal sexual risk engagement did not differ between conditions. This finding echoes challenges modifying condom use practices and attitudes observed in other intervention approaches for HIV-infected MSM [12] and may reflect fatigue with risk reduction messaging related to condom use.

The small sample size limited our ability to conduct analyses examining dynamics of condom use within different partnerships (e.g., seroconcordant versus serodiscordant partners) associated with differing levels of HIV transmission risk (e.g., ARV medication use and adherence use within partnerships). Future interventions may benefit from tailoring intervention content for condom use and other risk reduction behaviors based on partner characteristics or other factors. For instance, in established relationships, particularly with HIV seroconcordant steady partners, condom use norms are typically well-established, with most partners opting for sex without a condom [49]. In this example, intervention content addressing other risk behaviors (e.g., concurrent sexual partnerships) and health promotion strategies (e.g., ARV adherence, routine STI testing) may better address a particular individual's overall sexual health.

Informed by Coping Effectiveness Training for HIV-infected MSM [35, 50], our intervention integrated content on stress management and coping skills with sexual risk reduction. Participants' coping self-efficacy increased and the degree of perceived stress decreased. Although stress management interventions for HIV-infected individuals have typically been implemented across multiple, group-based sessions by facilitators with specialty training in mental health [34, 51, 52], results from this study suggest that stress management training to enhance coping can be delivered by trained peer interventionists. However, the intervention did not enhance participants' perceived social support. Findings have been mixed regarding the efficacy of stress management interventions to improve social support among HIV-infected individuals [34]. Group-delivered interventions may provide a forum for HIV-infected MSM to expand their social networks and garner support from others. Indeed, in the current sample, 40% of participants took advantage of the supplemental support group sessions. It may be that the follow-up interval was too brief to capture improvements in social support. Alternatively, the intervention content may not have addressed sufficiently the myriad of factors that can affect HIV-infected MSM's level of social support (e.g., experiences of stigma, discrimination; [33]).

Participants rated the intervention sessions' content favorably, endorsing that the intervention provided helpful, interesting, and important information and that they would recommend the intervention to their friends. These results suggest that integrating sexual risk reduction content within a more holistic intervention that addresses broader coping and stress management needs for HIV-infected MSM is acceptable. Such findings are consistent with our formative, qualitative work suggesting that interventions with an exclusive focus on safer sex and HIV prevention messaging would not be well-received [20]. Our intervention was implemented by knowledgeable MSM facilitators and participants reported they were friendly, likeable, helpful, caring, and knowledgeable. Similar to other interventions that have employed peer interventionists (e.g., [53]), it may be that participants found the intervention facilitators to be more approachable; future research may benefit from further examination of the extent to which specific facilitator characteristics moderate intervention acceptability.

Recent secondary prevention intervention approaches for HIV-infected MSM have examined the efficacy of provider-delivered [13, 16, 54–56] or peer-delivered [53] interventions that can be integrated within ongoing HIV specialty care or primary care settings for newly HIV diagnosed MSM [17, 57]. Additional studies have examined the efficacy of secondary prevention interventions for MSM delivered with a group format [58], combining group and individual counseling [59], or using online-delivered interventions [60] or computer-supported interventions [61]. Additional research to understand for whom a particular intervention approach is most efficacious along with strategies to optimize engagement with a given intervention modality is needed. For example, the use of an adaptive intervention approach [62] could facilitate ongoing assessment of sexual risk behaviors and guide the selection of an appropriate intervention approach for a particular individual.

Strengths and Limitations

Strengths of this study include the development of a theoretically informed intervention that addressed both sexual health and stress management skills tailored to the needs of HIV-infected MSM. Additionally, our study design allowed participants in both study conditions to receive the intervention.

Several limitations should also be noted. First, the analyses did not account for level of engagement in the supplemental social support sessions. Second, the small sample size precluded analyses examining potential moderators of intervention efficacy (e.g., participant characteristics, relationship status, adherence to ARV medications) and analyses examining potential dose effects based on number of intervention sessions attended. Our intervention was developed and implemented prior to the widespread availability of PrEP and other biomedical HIV prevention approaches. As such, the extent to which our intervention could be integrated within the broader HIV prevention landscape is unknown. This study was also conducted with a small sample of HIV-infected MSM living in a medium-sized Northeastern US city, so caution is warranted generalizing study findings to other HIV-infected MSM.

Conclusions

Ongoing secondary prevention efforts can help to reduce the number of new HIV infections and promote HIV-infected MSM's sexual and mental health. Interventions that provide a combined focus on sexual risk reduction and mental health treatment are acceptable and may be preferable to HIV-infected individuals. These interventions can help to reduce both psychological distress and sexual risk behavior. Further research is needed to examine the extent to which this intervention is efficacious in producing sustained change. Given cost constraints and limited resources to implement group-delivered interventions in HIV care settings, strategies to identify individuals for whom may this intervention is most efficacious are also warranted as are alternative administration approaches (e.g., online).

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Compliance with Ethical Standards

Conflicts of interest All authors declare they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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