

An Ecosystem-Based Intervention to Reduce HIV Transmission Risk and Increase Medication Adherence Among Inmates Being Released to the Community

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Abstract

HIV+ inmates reentering their communities are at increased risk for poor health outcomes and for transmitting HIV. This article reports on a randomized trial comparing an ecosystem-based intervention and an individually focused intervention for reducing HIV transmission risk and improving medication adherence. Reincarceration was considered as a secondary variable. Both groups decreased sexual risk behavior over the 12-month follow-up period. Unexpectedly, the ecosystem intervention group was less likely to be taking medication or to be adherent and more likely to have been reincarcerated. Failure to demonstrate a significant advantage of the ecosystem intervention may have resulted from the difficulty of engaging family and other ecosystem members in the intervention. Implications for developing and applying interventions for this population are discussed.

Keywords

HIV, inmates, intervention, adherence, reentry

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Introduction

Reentry following incarceration is universally challenging, as individuals seek to resume interrupted family, friendship, employment, and social service relationships (Baillargeon, Hoge, & Penn, 2010; Braithwaite, Stephens, Treadwell, Braithwaite, & Conerly, 2005; van Olphen, Freudenberg, Fortin, & Galea, 2006). Reentering individuals living with HIV face the additional challenges of timely access to medical care, adhering to medications, and avoiding transmitting HIV to others (Wohl et al., 2011). These individuals are often released with minimal supplies of medication and without adequate transitional support to health care in their communities. Release from prison is associated with decreased medication adherence and poor health outcomes (Baillargeon, Giordano, et al., 2010; Palepu et al., 2004; Stephenson et al., 2005). The stresses of incarceration and community reentry, including relationship and housing instability, increase the risk for unprotected sex and concurrent sexual partners (Grinstead, Zack, & Faigeles, 2001; Harman, Smith, & Egan, 2007).

There have been multiple calls for the development of effective interventions to address the specific needs of HIV+ individuals reentering their communities (Baillargeon, Giordano, et al., 2010; Myers et al., 2005; Vlahov & Putnam, 2006). An early study tested the effectiveness of an intervention in which community service providers met with participants prior to release; after release, intervention participants reported more service utilization and less sexual risk behavior compared to a wait list control (Grinstead et al., 2001). Based on in-depth qualitative interviews, Nunn et al. (2010) concluded that intensive case management improves utilization of medical care and social services after release. In one of the few randomized trials of an intervention for HIV+ releasees, however, Wohl et al. (2011) found no significant differences between intensive case management and the prison's standard pre-release discharge planning. Other innovative approaches have been proposed. Spaulding et al. (2009), for example, explored the feasibility of using prison volunteers as "life coaches" addressing issues such as family reunification and relapse prevention. While these studies have begun to describe the specific needs of HIV+ persons leaving incarceration and to explore intervention outcomes, there remains an urgent need to develop a toolkit of tested interventions that have the potential of being broadly disseminated. In addition, studies have primarily addressed medication adherence and recidivism; sexual risk reduction has yet to be sufficiently addressed.

There has been an increasing awareness of community reentry as a social process (Draine, Wolff, Jacoby, Hartwell, & Duclos, 2005) and of the role of family and friends in successful community reentry (Barreras, Drucker, & Rosenthal, 2005; Golembeski & Fullilove, 2005; Visher & Travis, 2003). This may be particularly true for returning prisoners with special needs, such as those with mental illness or those coping with HIV (Hammett, Roberts, & Kennedy, 2001) and for people of color, who are vastly overrepresented among U.S. prisoners (Bureau of Justice Statistics, 2010; Franklin, Boyd-Franklin, & Kelly, 2006). Freeman, Rodriquez, and French (1996) found that among HIV+ injection drug users, social support from family and friends influences patients' adherence to their HIV medication. The importance of social relationships is also implied by the association between housing stability and postrelease care utilization among HIV+ releasees reported by Harzke, Ross, and Scott (2006). Family and friends may have a positive effect on medication adherence through encouragement, promotion of the importance of adherence, and serving as a reminder mechanism to the HIV-infected individual (Johnson et al., 2003; Remein et al., 2006).

Given the social nature of community reentry, developing interventions that actively involve family, friends, and other support persons may be effective to reduce risk behavior following release. Ecosystem interventions focus on transforming interactions between individuals and their multiple ecosystems, defined as families and other systems that impact their lives, such as the criminal justice and social welfare systems. These interventions involve assessing the ecosystems, entering the ecosystems through counseling interventions, and restructuring interactions and roles within each ecosystem. Szapocznik and colleagues have successfully developed and tested ecosystemic

interventions addressing a diversity of populations and behaviors (e.g., Eisdorfer et al., 2003; Feaster, Mitrani, et al., 2010; Mitrani, McCabe, Weiss-Laxer, Robinson, & Feaster, 2010; Mitrani, Szapocznik, & Robinson-Batista, 2000; Robbins et al., 2008; Szapocznik & Kurtines, 1989; Szapocznik & Williams, 2000). One recent study focused on HIV+ women returning to their communities after drug treatment and found that those randomized to an ecosystem-focused intervention showed improvement in HIV medication adherence and reduced relapse to drug use compared to an individually focused intervention (Feaster, Brincks, et al., 2010; Feaster, Burns, et al., 2010). Such interventions could be particularly relevant to community reentry for HIV+ persons who are negotiating multiple ecosystems in an effort to meet their needs for care and support following release.

To test the incremental usefulness of an ecosystem-based intervention in facilitating community reentry, we conducted a behavioral trial to determine if an ecosystem-based intervention would be more effective than a previously tested individually focused intervention in reducing HIV transmission risk and improving medication adherence among HIV+ people being released from incarceration. Prison and jail releasees were randomly assigned to receive either (a) an ecosystem-based intervention (e.g., Feaster, Mitrani, et al., 2010; Szapocznik et al., 2004) modified to meet the specific needs of people being released from custody or (b) an individually focused intervention based on interventions previously shown to be effective in reducing reentry risk (e.g., Grinstead et al., 2008; Wolitski & The Project START Writing Group, 2006). Detailed descriptions of the interventions, intention-to-treat (ITT) analyses of the main outcome variables, and analysis of secondary outcomes are presented.

Method

Study Sites

Data were collected at three sites: two prisons (California Medical Facility and San Quentin State Prison) and one jail (San Francisco County Jail; SFCJ). California Medical Facility (CMF) is a state prison 50 miles northeast of San Francisco. It houses approximately 3,200 prisoners, and it is one of the four facilities in California designated to house and treat male prisoners who are known to be HIV+. During the study period, 65% of the HIV+ men at CMF were being treated with highly active anti-retroviral therapy (HAART). The prison measured viral load every 3 months and provided a 30-day supply of medications upon release. San Quentin State Prison (SQSP) is the California prison system "reception center" for the greater San Francisco region; most known HIV+ prisoners at San Quentin are either transferred to CMF or are released after a short period of time. At all California state prisons, HIV+ people who are paroling are offered a parole-sponsored transitional case management program. This is a voluntary program and not all choose to participate. The SFCJ houses approximately 2,100 inmates in nine locations on any given day. During the study period, 2% to 5% of the county jail inmates were HIV+. Of those, approximately one third were being treated with HAART. Ideally, all prisoners released from custody on HAART left the facility with a 7-day supply of their HIV medications and a 30-day prescription for their HIV and other medications. However, many were released from custody earlier than expected or without prior notice and did not receive the medications.

Study Personnel

Field staff included two recruiters, two interviewers, and three counselors. Recruiters informed potential participants about the study, obtained informed consent, and conducted the initial health education session (IHES). Interviewers conducted all the face-to-face assessments and traced participants for follow-up after the intervention had been completed. Counselors conducted both the ecosystem intervention and the individually focused comparison intervention as described below. Interviewers were employed, trained, and supervised through the University of California San

Francisco (UCSF) Center for AIDS Prevention Studies. Recruiters and counselors were employed, trained, and supervised by the community-based organization Centerforce.

The interviewers were selected and trained by the principal investigator (PI). Their initial 2-week training was based on a standardized assessment manual including all assessment procedures and question-by-question instructions for each survey. Training also included extensive role-playing of survey administration. Each interviewer received 30 to 60 minutes of individual supervision from the PI each week. Supervision involved a discussion of surveys conducted the previous week, a page-by-page review of each survey to discuss questions or issues regarding survey administration or specific survey questions, and review of any procedural concerns. Recruiters were trained on the study's eligibility criteria, recruitment procedures, the consent process, and randomization and in providing the IHES offered to all study participants. Counselors were trained and supervised by a clinician experienced in delivering family and ecosystem interventions in research settings. The training was both theoretical and practical, with ongoing clinical supervision throughout the intervention. Counselors audio-recorded selected intervention sessions, and these tapes were used by the clinical supervisor to confirm intervention fidelity. Training for all staff included institutional safety and procedural operations for each participating institution.

Recruitment Procedures

All three recruitment institutions kept a continuously updated list of HIV+ inmates who were about to be released. Each week, the study recruiter identified and met with potential participants who were within 21 to 90 days of their release back into the community. The recruiter asked potential participants if they wished to hear about the study and, if they were interested, the recruiter reviewed eligibility criteria and conducted the consent process in a confidential space. Eligibility criteria were (a) over 18 years of age, (b) being released to one of the nine San Francisco Bay Area counties, (c) able to speak English or Spanish, (d) able to name at least one adult in the local area who would be able to participate in the intervention with them, and (e) willingness to sign a release for the recruiter to contact that person. Upon confirmation of eligibility, the recruiter obtained informed consent by reading the consent form aloud with the participant, answering any questions, and asking the participant to sign or initial the form. Participants were offered a blank, unsigned copy of the consent form for their reference. The recruiter then scheduled the prerelease assessment. Ability to read or write was not required, as the consent form was read to all participants and all assessment instruments were interviewer-administered. All procedures were approved by the UCSF Committee on Human Research.

Prerelease Assessment

The first assessment (prerelease) occurred in prison or jail as soon after the recruitment appointment as possible, generally within 5 days, and prior to randomization. The 60- to 90-minute prerelease survey measured risk behavior and behavior related to medical adherence during the 4 months immediately preceding the current incarceration. An interviewer would complete a request to meet with the potential participant and arrange for a confidential meeting space in the prison or jail. When the participant arrived at the appointment, the interviewer would introduce herself and remind the participant about their recruitment to the study, that participation was voluntary, and that she would be meeting with the participant again for follow-up surveys in the community. All surveys were conducted face-to-face; interviewers noted participants' responses in standardized survey booklets (electronic devices, including laptops, were not allowed into the institutions). Interviewers and counselors did not share information about the participants to prevent the interviewers from having knowledge of participants' treatment assignment and to ensure that participants were free of concern about the consistency of their responses to counselors and interviewers. In addition to assessing specific sexual and substance use

behaviors and behavior related to adherence, the surveys assessed various attitudes, beliefs, and circumstances (e.g., social support, housing, employment) that have been found to be related to sexual risk, adherence, and/or postrelease success. The surveys had been tested with 10 pilot study participants using procedures identical to the intervention trial procedures.

Initial Health Education Session (IHES)

Following the prerelease assessment but prior to randomization, each participant received a 45-minute health education session delivered by the recruiter for the purpose of providing all participants with the same basic information related to HIV transmission risk and HIV medication adherence. IHES sessions included an explanation of how the virus works, a clarification of the difference between HIV and AIDS, and an overview of common opportunistic infections. The IHES also presented basic information about HIV transmission and prevention techniques related to sex and needle sharing, including the use of condoms and barriers, needle cleaning, and needle exchange. To address HIV medication adherence, the IHES offered information about the importance of medical adherence and its role in preventing opportunistic infections, minimizing viral replication, and averting development and transmission of treatment-resistant virus, and also offered basic memory strategies to enhance medication adherence compliance and optimize visits with health care providers (e.g., writing lists of questions prior to appointments).

Randomization

Randomization was stratified by recruitment site. Prior to the study, stratum-specific sequential ID numbers were generated and randomly preassigned to intervention groups. Only the PI and project manager had access to the link between ID numbers and treatment assignments. Upon enrollment, each participant received the next site-specific ID number. After the IHES, the recruiter, who was blind to the randomization assignment, and the participant opened a sealed envelope that was printed with the participant's ID number and contained a card showing the ID number and intervention group assignment.

Intervention Procedures

Ecosystem Intervention. The goal of the ecosystem intervention was to restructure interactions within the participant's ecosystems to support HIV transmission risk reduction and HIV medication adherence. The counselor achieved this restructuring through three core activities: (a) assessing the membership, functional patterns, and roles in the participant's ecosystems, including his family, friends, sexual and drug using partners, and service providers; (b) connecting with the participant's ecosystems through joint meetings and other communication; and (c) restructuring interactions and roles through direct interventions.

The ecosystem intervention proceeded in three phases: (a) *initiation*, during which the counselor built the therapeutic alliance and mapped the participant's ecosystem, and *initial joining*, in which the counselor established his or her role in the participant's ecosystem; (b) *treatment*, in which the restructuring interventions were conducted through both individual and group counseling sessions and newly acquired interaction patterns within ecosystems were reinforced; and (c) *termination*, in which treatment sessions tapered off and ended. Throughout treatment and at the termination, counselors offered facilitated referrals as needed.

The ecosystem intervention consisted of two individual intervention sessions prior to release and up to 16 intervention sessions in the 4 months following release. The intervention was family- and ecosystem-focused; postrelease intervention sessions could be with the participant alone, with the

participant and his family (including intimate partners, siblings, parents, etc.), or with the participant and other ecosystem members (friends, service providers, or others whom the participant had identified). Each participant defined who the members of his ecosystem were. Postrelease sessions were conducted at community agencies, in participants' homes, and in other venues convenient to the study participant and family or ecosystem members participating in the session. Sessions also took place at sites associated with a family or ecosystem member to help the participant establish a connection with the system or to improve a family member's interaction with the system (e.g., a family member's home, community service provider office).

Counselors sometimes conducted multiple sessions per week, although having more than three sessions in any week was reserved for crisis situations or unusual opportunities (e.g., someone who had been difficult to engage became available to attend a session). In cases with a high frequency of sessions, counselors attempted to taper off treatment in the final month so that the participant could achieve greater independence.

Individual Intervention. The individual intervention was designed as a comparison treatment to test the efficacy of the ecosystem intervention and was based on the Project START intervention, which had already been shown to facilitate risk reduction among men with imminent release from prison but not specifically HIV+ men (Wolitski & The Project START Writing Group, 2006). The goal of the individual intervention was to provide information and support regarding (a) the reduction of sexual and drug-related HIV transmission risk and (2) the promotion of HIV-related medication adherence. Like the ecosystem intervention, the individual intervention consisted of two sessions prior to release and up to 16 individual sessions in the 4 months following release. The intervention was individually focused and the counselor and participant typically met alone. While there may have been occasional, casual contact with members of the participant's ecosystem in the process of tracing, calling, or visiting the participant, the individual intervention focused on supporting the participant's individual efforts to reduce HIV transmission risk and increase HIV-related medical adherence. Counseling sessions were client-centered and focused on each participant's individual goals and objectives. The participant, with the support of the counselor, established goals and objectives in the initial session and worked with the counselor to achieve and modify the goals as the intervention progressed. Intervention techniques included motivational interviewing, facilitated referral, and goal setting.

Follow-Up Assessments

Four assessments were conducted. The first assessment occurred in prison or jail and measured risk behavior and behavior related to medical adherence in the 4 months before incarceration as well as adherence while incarcerated. The second assessment was conducted immediately following the completion of the intervention (4 months postrelease) to assess the immediate impact of the interventions. Additional assessments were conducted at 8 and 12 months postrelease to determine the longer term impact of the interventions. Follow-up assessments were conducted using procedures identical to the prerelease assessment. The follow-up surveys were conducted at a location in the community that was convenient to the participant or, if the participant was reincarcerated, at that institution. In 17 cases, the 8-month postrelease survey served as the final assessment because all study activities ended before the participant had been in the community for a full 12 months. Of these participants, 15 received this final interview and 2 were lost to follow-up.

Participant Reimbursements

Participants were paid \$40 for the prerelease survey; most participants received this reimbursement upon release and a few requested that the money be posted to their prison or jail account. Participants

were paid \$40 for the 4-month and \$50 each for the 8-month and 12-month follow-up surveys. Payments were made in cash with the exception of payments posted to prison/jail accounts for those who were reincarcerated.

Data Management

Surveys were cleaned by the project manager and unclear responses were clarified with the interviewer prior to data entry. Data entry was conducted by one staff member. The data set was cleaned by comparing a case-by-case data report with each hard copy survey (a 100% data audit). The project manager corrected any data entry and logical inconsistency errors in each data record in the database and submitted the final cleaned database to the statistician for analysis.

Measures

Demographics and descriptive variables included age, education, ethnicity, sexual orientation, gender, relationship status, lifetime incarcerations, income level, and source of income. Although all participants were recruited from a men's prison facility, we anticipated some diversity in regard to gender identity and therefore asked respondents if they identified as male, female, transgender, or "other."

The primary outcomes of the study were sexual risk behavior and medication adherence. Sexual behaviors were assessed via 4-month retrospective time frames. At the prerelease assessment, participants reported on the 4 months prior to incarceration, and at each follow-up assessment, participants reported on behaviors during the previous 4 months. At each assessment, specific sexual behaviors were assessed with up to the five most recent sexual partners, starting with the most recent partner. Unprotected sex was defined as insertive vaginal or anal sex that was not condom protected. We created a binary indicator of at least one unprotected sex episode with any partner. The definition of *serodiscordant* unprotected sex further required that a sex partner be HIV-negative or of unknown serostatus. We also created a binary outcome specific to serodiscordant unprotected sex.

At each assessment, participants were asked to name their currently prescribed antiretroviral medications, the prescribed dosing schedule, and the number of doses they actually took during each of the prior 3 days using a modified version of the AIDS Clinical Trials Group questionnaire (Chesney et al., 2000). We also longitudinally assessed whether each participant *should have* had antiretroviral medication prescribed: those who ever had a prescription, those with a viral load over 100K, those with a CD4 count below 200, those with an AIDS diagnosis, or those with HIV-related symptoms including recurrent infections, weight loss, fever, persistent fatigue, and night sweats. Based on this information, two longitudinally assessed binary medication outcomes were constructed: (a) whether the participant was taking medication for HIV and (b) whether the participant was adherent to his HIV medication. The latter outcome contrasted those who either did not require HIV medications or who reported taking all of their prescribed doses in the 3-day recall versus those who either should have been taking HIV medications and were not or who were taking medications and reported missing at least one dose in the 3-day recall measure.

In addition to the two primary outcome variables, reincarceration was assessed as a secondary variable of interest at each follow-up survey by asking participants if they had been locked up at any time during the prior 4-month recall period, how many times they had been locked up, and the total number of days they had been locked up. "Locked up" was defined as spending any time in jail or prison, including being held overnight or for a short period of time prior to making bail. Participants were also asked to indicate all applicable reasons why they had been locked up during the recall period from the following list: arrested for an old felony charge, arrested for a new felony charge, arrested for an old misdemeanor, arrested for a new misdemeanor, or parole or probation violation.

Analysis Plan

A randomization check compared characteristics of the two intervention groups using chi-square and *t* tests. ITT analyses compared intervention groups as randomized. Mixed logistic regressions modeled repeated assessments of each primary outcome and included random intercepts for participants and a three-category recruitment site covariate, and produced maximum likelihood estimates via Gaussian quadrature. For anti-HIV medication usage and sex risk behaviors, outcomes assessed at all four time points were modeled (i.e., prerelease and all postrelease assessments). For reincarceration outcomes, only postrelease outcomes were modeled. All models tested omnibus effects of intervention groups, categorical time, and the groups-by-time interaction. Additional custom tests included comparisons of intervention groups at each assessment, comparisons of groups pooling across all postintervention assessments, linear time trends across all four assessments as well as across all postrelease assessments, and corresponding groups-by-linear time interactions. Odds ratios for linear effects of time represent a change from one assessment to the next.

We also considered two alternative analyses. The first further divided the ecosystem group into those with and without family involvement in intervention sessions. The second augmented the ITT analyses of sexual risk and medication use outcomes to include a time-varying covariate describing the percentage of time each respondent was incarcerated during the corresponding 4-month retrospective timeframe (0%, > 0% to 25%, >25% to 50%, >50% to 75%, >75%). We found no substantive differences in results compared to the ITT analyses.

Results

Participants

As shown in Table 1, at the prerelease assessment, participants were primarily African American (52% overall) with an average age of 42 years. While the majority of participants described themselves as heterosexual, 24% described themselves as homosexual or bisexual. Although we recruited participants at a facility intended to house male prisoners, 11% of participants described themselves as female, transgender, or other. Most participants described themselves as single (67%) and most had a high school degree or less (74%). Reported financial circumstances prior to their current incarceration included a low income, with 26% earning less than \$500 per month, an additional 44% earning less than \$1,000 per month, and 50% receiving some sort of public assistance. There was a wide distribution in the number of previous incarcerations among the study participants; however, 30% reported being incarcerated more than 21 times.

Recruitment and Retention

Figure 1 shows the process of recruitment and retention for this study. Overall, 325 individuals were recruited and assessed for eligibility. Of those, 163 were excluded from study participation for the reasons noted in Figure 1, and 162 participants gave informed consent and were assessed and randomized to either the ecosystem intervention or the individual intervention (81 participants in each condition). Of these, 6 were dropped from the individual intervention and 5 from the ecosystem intervention due to administrative issues such as failure to be released from prison during the study period or unexpectedly being released outside the geographical area, leaving 151 participants for ITT analyses: 75 in the individual intervention and 76 in the ecosystem intervention. Overall, 151 participants completed the prerelease assessment, 92% completed the 4-month assessment, 89% completed the 8-month assessment, and 76% completed the 12-month assessment. There were no significant differences in retention between the two intervention groups.

Table 1. Demographics of Study Sample ($N = 151$).

	Ecosystem		Individual	
	<i>N</i>	%	<i>N</i>	%
Ethnicity, $p = .5803$				
African American	37	48.7	42	56.0
Latino	10	13.2	12	16.0
White	19	25.0	15	20.0
Other	10	13.2	6	8.0
Age, ^a $p = .6884$	42.0	7.9	41.4	7.8
Sexual orientation, $p = .6088$				
Heterosexual	47	61.8	51	68.0
Bisexual	13	17.1	8	10.7
Homosexual	13	17.1	10	13.3
Other	3	4.0	6	5.3
Gender, $p = .6821$				
Male	68	89.5	67	89.3
Female	2	2.6	2	2.7
Transgender	5	2.6	3	4.0
Other	1	1.3	3	4.0
Relationship status, $p = .3530$				
Single	52	68.4	49	65.3
Married/domestic partner	12	15.8	8	10.7
Single, divorced, widowed	12	15.8	18	24.0
Education, $p = .7654$				
Less than HS degree	27	35.5	28	37.3
HS degree or GED	30	39.5	26	34.7
More than HS degree	18	23.7	21	28.0
Monthly income, ^b $p = .6438$				
Less than \$500	22	29.7	17	23.6
\$501 to \$1000	31	41.9	35	48.6
Greater than \$1000	21	28.4	20	27.8
Source of income, $p = .4877$				
Work	9	12.3	14	19.4
Public assistance	38	52.1	37	51.4
Both	9	12.3	10	13.9
Neither	17	23.3	11	15.3
Lifetime incarcerations, $p = .5135$				
1 to 10	16	29.9	24	38.7
11 to 20	17	30.9	15	24.2
21+	22	40.0	23	37.1

Note. HS = high school; GED = general education diploma.

^aThe number in the *N* column is the mean and the number in the % column is the standard deviation.

^bThis is monthly income over the 4-month period prior to the index incarceration.

Intervention Compliance

There were no significant differences between the two interventions arms in the level of exposure to the assigned intervention. The mean dose in the ecosystem intervention was 9.5 sessions ($SD = 5.0$) and 9.9 ($SD = 5.2$) in the individual intervention. The median number of sessions was 8 and 10 in the ecosystem intervention and in the individual intervention, respectively, with an identical interquartile range of 7 in each group.

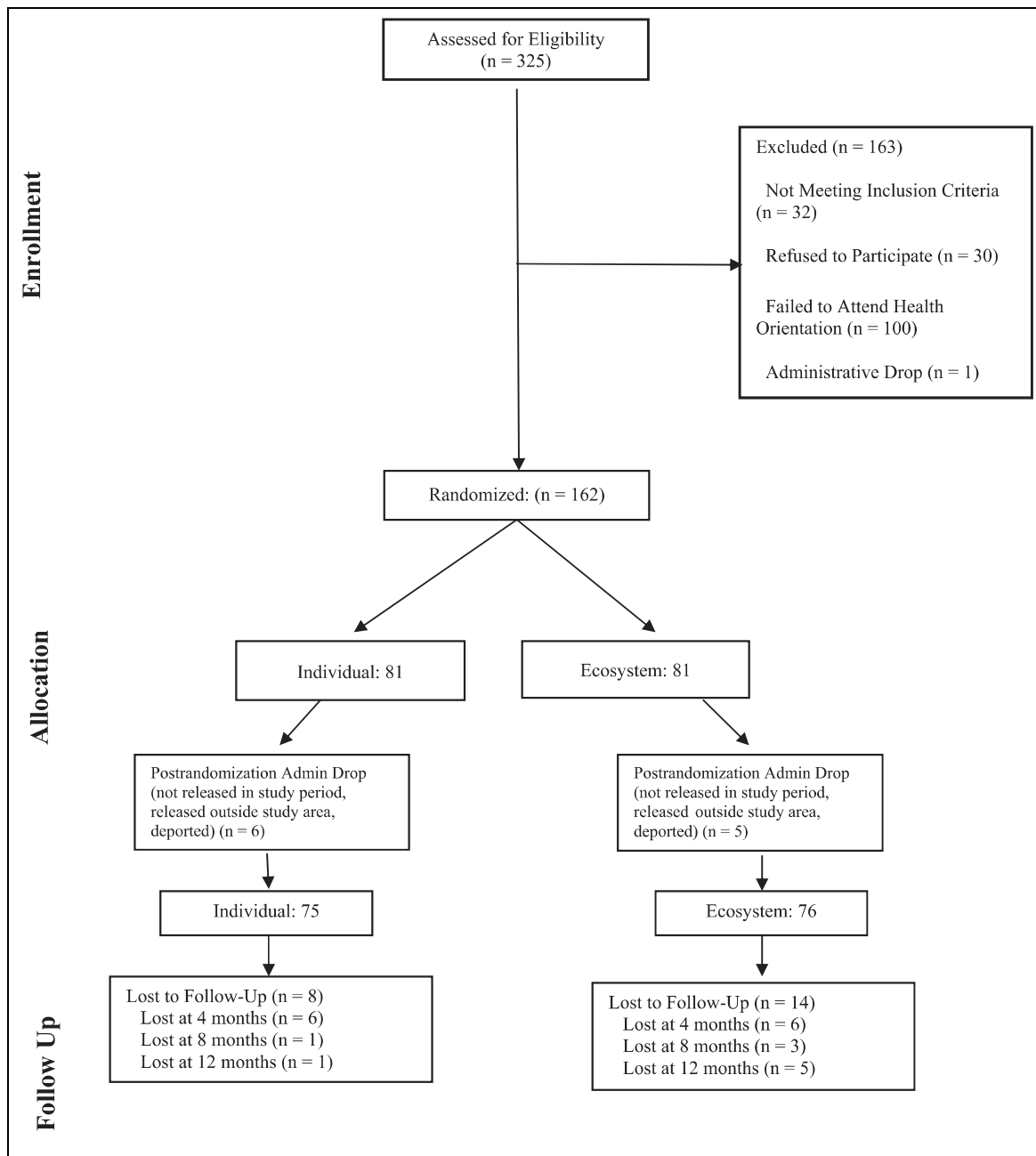


Figure 1. Study flow diagram.

For the purpose of describing intervention compliance, the expected intervention dose was defined slightly differently for the two conditions. In both conditions, participants were expected to have had a total of four sessions, at least two of which were after release from prison. A total of 60 of 76 participants (79%) in the ecosystem group and 60 of 75 participants (80%) in the individual intervention group met this first condition. In addition, participants in the ecosystem intervention group were expected to have had at least one postrelease session that included at least one family or ecosystem member. Fifty-two (68%) of the 76 ecosystem participants met both dosage expectations for that condition.

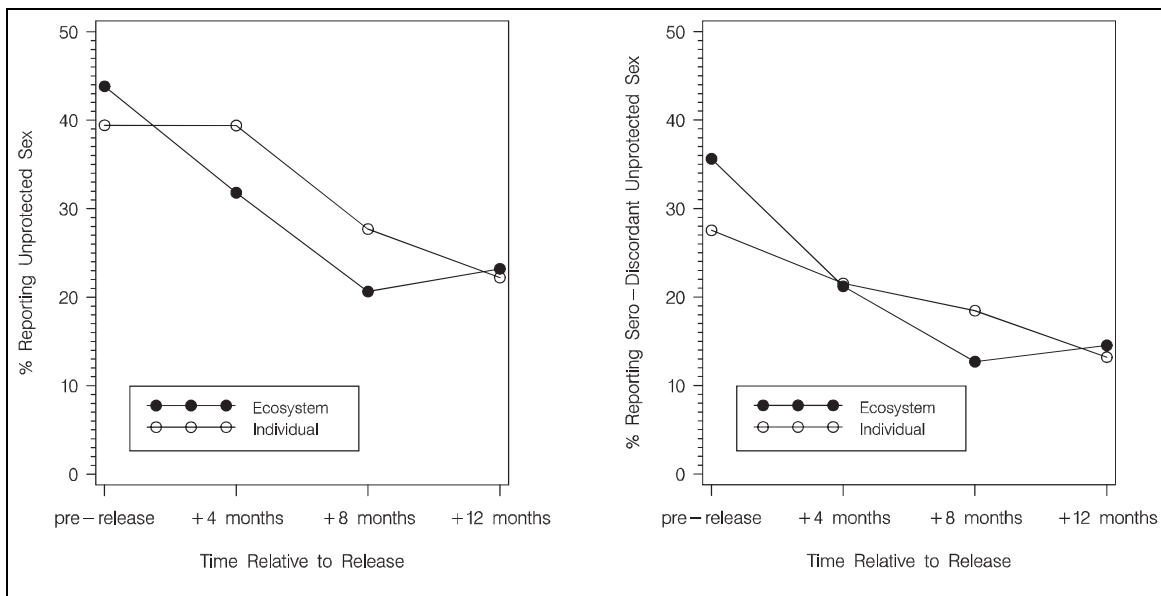


Figure 2. Sexual behavior outcomes.

Ecosystem members invited to participate in the intervention included family, friends, sexual and drug using partners, and social service providers of various types, including case workers and parole officers. Of the 76 participants in the ecosystem intervention, 28% had no ecosystem members attend a session with them, 34% had only service provider ecosystem members attend a session with them (no family or friends participated), and 24% had both family and service provider ecosystem members attend intervention sessions with them. Eleven percent of participants had only family members attend a session with them.

Sexual Behavior Outcomes

We found no differences between the intervention groups on the sexual behavior outcomes. Models of sexual risk outcomes revealed no effects of intervention groups or group-by-time interaction. Significant overall effects of time were observed for the unprotected sex and serodiscordant unprotected sex outcomes, $F(3, 359) = 7.10, p = .0001$ and $F(3, 353) = 6.78, p = .0002$, respectively (Figure 2). Tests of linear trends suggested significant declines of any unprotected sex across all four assessments as well as the three post-release assessments, odds ratio [OR] = 0.55 (95% CI: 0.42, 0.73), $p < .0001$ and OR = 0.63 (0.42, 0.95), $p = .0288$, respectively. For the outcome describing any episode of unprotected serodiscordant sex, the test of linear trend across all four assessments was significant OR = 0.54 (0.40, 0.73), $p < .0001$.

Medical Adherence Outcomes

As shown in Table 2, models of anti-HIV medication usage and adherence suggested group main effects but no significant group-by-time interactions. Averaging across all postrelease assessments, ecosystem intervention group members were significantly less likely to be taking anti-HIV medications and to be adherent to their medication routine than those in the individual intervention group, OR = 0.20 (0.05, 0.80), $p = .0236$ and OR = 0.35 (0.13, 0.95), $p = .0408$, respectively. In addition, corresponding group differences were noted at the 4-month postrelease assessment.

Table 2. Percentage Reporting Anti-HIV Medication Usage and Adherence.

	Time Relative to Release				
	Prerelease N = 151	+4 Months N = 139	+8 Months N = 135	+12 Months N = 129	All Postrelease N = 403
Taking anti-HIV medication					
Ecosystem	53.4	33.9 ^A	45.3	52.7	43.5 ^b
Individual	64.4	57.1 ^A	58.1	62.3	59.0 ^b
(Pooled)	58.9	45.3 [‡]	51.6 [‡]	57.4 [‡]	53.4
Anti-HIV medication adherence					
Ecosystem	56.7	40.0 ^c	46.8	42.3	43.1 ^d
Individual	67.2	57.4 ^c	53.5	58.0	56.2 ^d
(Pooled)	61.9	48.8	50.0	50.0	53.0

Notes. Percentages sharing a common superscript denote *p* values of corresponding group comparisons: lowercase letter, *p* < .05; uppercase letter, *p* < .01. Superscript daggers (‡) denote significant linear effects of time across the three postrelease assessments (*p* < .01).

Table 3. Percentage Reporting Postrelease Incarceration.

	Time Relative to Release			
	+4 Months N = 139	+8 Months N = 135	+12 Months N = 129	All Postrelease N = 403
All causes				
Ecosystem	47.8	70.1	64.9	60.6 ^a
Individual	39.1	53.7	49.1	47.2 ^a
(Pooled)	43.5 [‡]	61.9 [‡]	57.0 [‡]	53.9
For parole violation				
Ecosystem	31.9	58.2	47.3	45.5
Individual	33.3	41.5	41.8	38.6
(Pooled)	32.6 [‡]	50.0 [‡]	44.5 [‡]	42.1
For new offense				
Ecosystem	17.4	14.9	21.8	17.8
Individual	11.6	12.3	7.3	10.6
(Pooled)	14.5	13.6	14.5	14.2

Note. Percentages sharing a common superscript denote *p* values of corresponding group comparisons: lowercase letter, *p* < .05. Superscript daggers (‡) denote significant linear effects of time across the three postrelease assessments (*p* < .01). Indicators for new offenses and parole violations were not mutually exclusive; some individuals were incarcerated for both types of violations during a single postrelease period.

Averaging across groups, there were significant decreases between the prerelease assessment and the first postrelease assessment in the percentage of participants who were taking medication and in the level of adherence: OR = 0.31 (0.14, 0.70), *p* = .0051 and OR = 0.47 (0.23, 0.95), *p* = .0370, respectively. The percentage of participants taking anti-HIV medications increased across the post-release period, OR = 1.81 (1.16, 2.81), *p* = .0089, to approximate prerelease levels. There was no significant change in the adherence measure across the follow-up period.

Reincarceration Outcomes

Models of postrelease incarceration for all causes found that ecosystem group members, overall, were more likely to be incarcerated after release, OR = 2.88 (1.04, 8.01), *p* = .0435 (Table 3).

Additionally, averaging across intervention groups, significant linear decreases in incarceration for all causes and for parole violations were noted across the postrelease period, $OR = 1.75 (1.21, 2.54)$, $p = .0033$ and $OR = 1.63 (1.13, 2.34)$, $p = .0088$, respectively. There were no significant effects on the outcome describing postrelease incarceration for new offenses.

Discussion

Community reentry after incarceration is a challenging experience; successful community reintegration depends on the support of family, friends, and timely access to community resources. This process is even more complex for individuals living with HIV or facing other health challenges. Our previous studies demonstrated the effectiveness of individually focused interventions designed specifically for men leaving prison (Grinstead et al., 2008; Grinstead et al., 2001; Grinstead, Zack, Faigeles, Grossman, & Blea, 1999; Wolitski & The Project Start Study Group, 2006). This study was designed to determine if the addition of an ecosystem component could further reduce HIV risk and increase medication adherence. As a secondary variable of interest, we also examined being reincarcerated as a marker of successful reintegration. Results showed no main effect of intervention group for sexual risk behavior; both intervention groups reduced their sexual risk behavior and these changes were sustained over the follow-up period. Unexpectedly, men assigned to the ecosystem intervention reported poorer medical adherence and were also more likely to be reincarcerated over the follow-up period.

The results of this study suggest that the addition of an ecosystem component did not improve treatment outcomes (i.e., reductions in HIV risk behaviors, improvement in medication adherence) for HIV+ men leaving prison. To explore this finding, we examined actual family and other ecosystem member engagement in the intervention. One way to make a distinction between family and friends versus other ecosystem members is to consider those who are not being paid to work with the participant as “family,” in comparison to paid service providers (e.g., social workers, parole officers, residential counselors). Our finding that more than one third of those randomized to the ecosystem intervention did not have any family involvement suggests the intervention was not actually delivered as it has been in previous studies using the Structural Ecosystems Therapy (SET) model. In previous applications of the SET model with other populations, families and friends were consistently involved and counselors were more successful in integrating family with other systems, such as schools and social service agencies. Many of the participants in our study were not in contact with their families and were not able to engage any family members in the intervention. In addition, our recruiters reported that many potential participants did not meet the study eligibility criteria because they were unable to name and provide contact information for even one adult in the local area who could potentially engage in the intervention with them.

Most of our participants had been incarcerated multiple times prior to the incarceration during which they were recruited for this study, and many were reincarcerated during the follow-up period in addition to having ongoing struggles with employment, housing, and substance use after release. Our intervention process and results suggest that many participants were estranged from their families and this impeded the application of the ecosystem-based intervention model that has been feasible and effective with many other populations (Feaster, Brincks, et al., 2010; Feaster, Burns, et al., 2010; Feaster, Mitrani, et al., 2010; Mitrani et al., 2000; Robbins et al., 2008; Szapocznik et al., 2004). One implication of this finding may be that ecosystem interventions with this population need to be initiated earlier, perhaps in juvenile detention facilities, with the hope of interrupting a pattern of isolation and estrangement from family and other types of potentially supportive ecosystem members over time.

Despite the unexpected finding that participants in the ecosystem intervention were less likely to be on medication and less likely to be adherent to their medications, we noted an overall increase in

the percentage of participants who were on medication over the follow-up period. While this may be attributed to participation in an intervention, it is also the case that over time the number of men who met the clinical criteria for medication increased (they got sicker), and a corresponding increase in the number who were actually taking medication would be expected. It is also possible that a period of poor utilization of medical care immediately after release, which has been reported in previous studies (e.g., Baillargeon, Giordano, et al., 2010; Stephenson et al., 2005), was followed by return to care and increased adherence as the follow-up period progressed. It is also possible that the group differences were due, in part, to a nonsignificant imbalance between the groups on the prerelease adherence measures that favored the individual intervention group.

Reincarceration was a secondary outcome of interest, and prevention of reincarceration was not directly addressed in the interventions. However, it was unexpected to find that participants in the ecosystem intervention were more likely to be reincarcerated over the follow-up period. One possible explanation is that engaging the social services system in that intervention caused ecosystem intervention participants to be relatively more vulnerable to the discovery of behaviors that would violate their parole and lead to their reincarceration. However, this hypothesis is not supported by the presence of a corresponding pattern of group differences in new offenses as well as in parole violations.

In considering the failure to find significant differences between the two groups, several issues should be considered. First, the intervention group comparison was very rigorous; we compared the ecosystem intervention to one based on an individually focused intervention that had been shown to be effective in reducing sexual risk behavior in a similar population (Wolitski & The Project START Writing Group, 2006). Second, the type and level of involvement in the ecosystem intervention turned out to be quite limited despite intensive efforts on the part of counselors to involve family, friends, sexual and drug using partners, and service providers. This demonstrates the degree to which our respondents were isolated and may have “burned bridges” with their families and other ecosystems as a result of repeated incarceration, drug use, and so on. As a result, the ecosystem intervention may have too closely approximated an individual intervention. However, given the promising results of this approach with other populations (Feaster, Brincks, et al., 2010; Feaster, Burns, et al., 2010; Feaster, Mitrani, et al., 2010; Mitrani et al., 2000; Robbins et al., 2008; Szapocznik et al., 2004), more research is needed to determine the level of ecosystem support that is possible in this population and further explore the promise of ecosystem-based interventions that may take advantage of more limited networks of community support.

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