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Outcomes of a Peer HIV Prevention Program with Injection Drug and Crack Users: The Risk Avoidance Partnership

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Abstract

The Risk Avoidance Partnership (RAP) Project conducted in Hartford, Connecticut, tested a program to train active drug injectors and crack cocaine users as “Peer Health Advocates” (PHAs) to deliver a modular HIV, hepatitis, and STI prevention intervention to hard-to-reach drug users in their networks and others in the city. The intervention was designed to diffuse health promotion and risk reduction interventions by supporting PHAs to model prevention practices and deliver risk and harm reduction materials and information. We compared change in behaviors and attitudes between baseline and 6-month follow-up of 112 primarily African American and Latino PHAs, 223 of their drug-network Contact Referrals, and 118 other study recruits (total n=523). Results indicated significant HIV risk reduction among all study participants, associated with significant health advocacy action conducted by PHAs, and a relationship between exposure to the RAP peer-delivered intervention and risk reduction among all study groups. Findings suggest that active drug users' engagement in peer health advocacy can set in motion a feedback and diffusion process that supports both the continued work of the PHAs and the adoption of harm reduction and mimicking of health advocacy by their peers.

Keywords

substance abuse; HIV/AIDS; peer interventions; diffusion; social networks

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INTRODUCTION

Over the past decade, peer-delivered HIV prevention intervention models have become increasingly popular as researchers and health promoters attempt to move beyond individually focused behavioral approaches in order to address social and contextual contributors to risk and transmission. Peer interventions also aim to extend coverage and penetration of prevention services beyond those generally available from chronically under funded and under staffed community programs. Such interventions have been tested with gay and bisexual men (French, Power, & Mitchell, 2000; Hays, Rebchook, & Kegeles, 2003; Kegeles, Hays, Pollack, & Coates, 1999; Kelly, 2004; Kelly et al., 1992), low-income women (Sikkema et al., 2005), and injection drug users (Broadhead et al., 1998; Latkin, Hua, & Davey, 2004; Latkin, Sherman, & Knowlton, 2003; Wood et al., 2003), and some have been replicated with multiple populations and in different contexts (Anonymous, 1999). They include various approaches, from designs that provide less intensive training but for a larger number of peer educators (Broadhead et al., 1998) to those that provide more intensive training to fewer, with the expectation of more sustained peer activity over time (Latkin, Sherman et al., 2003). A key question arising from these studies is the strength of the diffusion effect of peer interventions and the sustainability of that effect over time.

The Risk Avoidance Partnership (RAP) Project was a four-year peer intervention study conducted in Hartford, Connecticut from 2000–2004. RAP developed and tested a program to train active drug injectors and crack cocaine users as “Peer Health Advocates” (PHAs) to deliver a modular HIV, hepatitis, and STI prevention intervention to hard-to-reach drug users in their networks at risk of HIV and other transmissible diseases, and to others in their communities (Dickson-Gomez, Weeks, Martinez, & Convey, 2006; Weeks et al., 2006). The RAP project design was based on the premise, embedded in community health promotion empowerment theory (Brown, 1991; Minkler, 1989), that training active drug users as “Peer Health Advocates” contributes significantly to community-level reduction in HIV risk by changing the environment through the presence of a positive force for harm and risk reduction. This positive force is the cadre of PHAs who transform their own practices, model risk prevention, and carry harm reduction messages and materials into high risk areas and diffuse them through their networks of at-risk community members. Thus, the design also incorporates concepts of innovation diffusion theory (Rogers, 1995) and dynamic social impact theory (Nowak, Szamrej, & Latane, 1990), both of which conceptualize the influence of trusted “models” with whom recipients can identify, and the power of their persuasive communication for the process of changing practices within a peer group. This article reports on the outcomes of that training and intervention program, both for those trained to deliver the intervention to their peers, and for their drug-network contacts who were recruited into the study.

METHODS

RAP assessed drug-related and sexual risks among a cohort of drug injectors and crack users who were recruited to be trained as Peer Health Advocates (PHAs). We compared them to a cohort comprising two to three drug-using network members referred by each PHA recruit, called Contact Referrals (CRs). We assessed PHAs' and CRs' reported risk behaviors, social network characteristics and relationships, attitudes regarding peer delivery of prevention intervention by active drug users, exposure to and provision of peer-delivered prevention efforts, and changes in these characteristics after conducting the RAP peer intervention training and dissemination program. All protocols for the recruitment and inclusion of participants, intervention components, and research and evaluation methods were reviewed and approved by an Institutional Review Board.

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Hypotheses for Outcome Analyses

As a peer intervention designed to affect the total network of Hartford drug users, we expected that the RAP intervention would reduce risks in all study participants between baseline and follow-up. However, we also anticipated greater effect of the RAP intervention on the trained PHAs, who directly received four intensive office sessions and 1–6 additional field sessions with project staff. Nevertheless, all study participants (PHAs and CRs alike) were potentially exposed to an unknown amount of RAP intervention delivered by PHAs in the community. To assess RAP intervention outcomes, we tested the following hypotheses:

1. All study participants will demonstrate:
    a. increased positive PHA efficacy attitudes and health promotional practices, and
    b. reduced drug-related and sex-related HIV/STI/hepatitis risk behaviors in the comparison of 6-month to baseline assessments of the study cohort.
2. PHAs who received 5 or more training sessions (four in-office and at least one field session) will show significantly:
    a. increased PHA efficacy attitudes and health promotional practices, and
    b. reduced drug-related and sex-related HIV/STI/hepatitis risk behaviors than their CRs and others in the comparison of 6-month to baseline assessments.

In addition, we explored the degree to which changes could be attributed to RAP interventions, as well as indications that diffusion of the intervention had occurred from the PHAs we trained, to the drug network contacts they recruited (CRs), and to other drug users in the study.

Outcome Evaluation Design

Peer interventions designed to diffuse materials and model practices and to effect changes throughout a population are non-linear in nature; they are designed to create a feedback system that generates its own reinforcement and reiteration, thereby having an exponential effect over time. Thus, standard linear evaluation designs have limited usefulness for measuring the intervention dynamics and outcomes. Instead, a combination of process tracking and multi-layered outcome assessment is needed to detect change and link it to the peer intervention activities.

In RAP, the process of peer implementation and diffusion of intervention effects was tracked through extensive and systematic ethnographic observation, interviewing, and documentation of intervention delivery and social interactions among drug users in the community before, during, and after provision of the RAP PHA trainings. Outcomes were measured by assessing participants' individual-level behavioral and attitudinal changes at intake and 6 months, by mapping the macro social network of participants to identify and observe the distribution of intervention effects, and by surveying a cross-section of drug users community-wide after completion of PHA training to assess reach of the intervention. The ethnographic component, reported elsewhere (Dickson-Gomez et al., 2006), complemented the behavioral and attitudinal measures in the pre/post surveys. Reports of the post-project cross-sectional survey of Hartford drug users is beyond the scope of this article, as is a full review of the macro-network analyses of intervention outcomes (Weeks et al., 2007). We focus here on the baseline and 6-month pre/post survey assessments as these reflect outcomes of the intervention.

Because of the diffusion goal of the RAP study and our desire to track dissemination of the intervention through drug user social networks in the city, we did not randomize participants into intervention and control arms for outcome evaluation of the intervention. We hypothesized that in a mid-sized city like Hartford (approximately 18 square miles with a population of

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around 124,000 in 2005), diffusion of intervention effects would soon "contaminate" a control arm, an expectation supported by our earlier drug-use network study that showed significant linkages among drug injectors and crack users across the city (Weeks, Clair, Borgatti, Radda, & Schensul, 2002). However, such contamination would be a *desired* effect of the diffusion process. The challenge was to detect changes that occurred as a result of the intervention, and to assure the validity of attributing those changes to RAP. Thus, our multi-level and mixed method approach to outcome evaluation was designed to overcome the problems of both Type 1 error (i.e., inferring intervention effect when there was none), and Type 2 error (inferring no intervention effect when it occurred).

Sampling and Comparison Groups

The RAP Project had two primary types of participants: the staff-recruited Peer Health Advocates (PHAs) and the PHA-recruited Contact Referrals (CRs). The sampling and recruitment approaches for these two groups differed. Eligibility criteria for all participants included 18 years of age or older, self-reported use of heroin or cocaine (injected, smoked, or sniffed) within the prior 30 days, ability and willingness to provide informed consent, and voluntary participation.

A targeted and purposeful sampling plan (Singer & Weeks, 1992; Watters & Biernacki, 1989) was used to identify and recruit active heroin and cocaine/crack users as candidates to become Peer Health Advocates (PHAs). Project outreach staff, who were African American and Latino and included some former drug users, as well as field ethnographers familiar with the community, conducted all walk-up introductions to select and recruit PHAs based on observations and knowledge of the individual. The sample was targeted to ensure representation of the primary ethnic groups of the Hartford drug-using population (who are predominantly African American and Puerto Rican/other Latino, with some non-Hispanic Whites) and drug-use groups (heroin and cocaine injectors, crack users, dual users, and non-injection heroin/cocaine users) (Weeks et al., 2001; Weeks et al., 1996). Female PHA candidates were over-sampled to ensure their adequate representation, because women drug users tend to be more isolated and often removed from street drug use/purchase settings, and therefore more difficult to reach (Cruz et al., 2006; Sherman, Latkin, & Gielen, 2001; Weeks et al., 1998).

Additional eligibility criteria for PHAs were designed to enhance the potential reach of the peer intervention by focusing on training people who might have greater access to other drug users or potentially greater influence over them. These included: a) evidence of "central" network status, either as indicated by our prior network study (Weeks et al., 2002) or observed or reported multiple linkages to other drug users through ongoing community outreach and observation, or b) status as a drug-use site "gatekeeper," i.e., one who controls access to a place where other drug users come to buy or use drugs.

All CRs entered the study by referral from a PHA candidate who had successfully completed the baseline survey. At intake, PHAs were given three referral cards. They were instructed to give the cards to others whom they knew were active heroin or cocaine/crack users or their current sex partner, and were told they needed to refer a minimum of two eligible CRs who successfully entered the study in order for the PHA to initiate the training. Interviewers encouraged PHAs to give the cards to people they saw or used drugs with regularly. The intention of this instruction was to increase the likelihood that, after training, PHAs would provide the RAP Peer-delivered Intervention to their CRs, among others in their networks and in the community. PHAs received a $5 "finder's fee" for each successful referral. CRs were ineligible to become PHAs and could only enter the study once; they also were not given cards to recruit drug users into the baseline and 6-month surveys. All CRs were asked to provide informed consent not in the presence of their PHA before being included in the study.

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RAP Interventions

Project RAP implemented a two level intervention program and assessed the outcomes of those interventions with each of the two primary study groups (PHAs and CRs). At the first (staff-delivered) level, PHAs received the RAP Peer Health Advocacy Training Curriculum (Weeks et al., 2004; Weeks et al., 2006). This program was modeled after a similar one tested in Baltimore, Maryland (Latkin, 1998; Latkin, Sherman et al., 2003), though we added a significant staff-PHA partnered community component based on community empowerment theory to emphasize advocacy action. We also revised content of the training and intervention on the basis of local ethnography (Weeks et al., 2001) and PHA input during the pilot (Weeks et al., 2006).

The RAP PHA Curriculum was a 10-session, theoretically driven interactive training program. Sessions 1 through 4 were small group and staff-delivered in the offices of our community-based research institute. Sessions 5 through 10 were one-on-one, partnering each PHA with a staff person, who observed while the PHA engaged in delivering the RAP peer intervention in the community. All PHA training sessions were two hours in duration for which participants received an incentive of $20. Written materials were available in both English and Spanish, and Spanish interpretation by bilingual/bicultural staff was available as needed or requested. Staff who conducted training had significant expertise in substance abuse and HIV, were trained in group facilitation and communication techniques, and were experienced in community HIV prevention outreach and education.

Group in-office sessions provided basic information on HIV and its transmission and prevention, as well as on hepatitis, other sexually transmitted infections (STIs), and other common health concerns affecting drug users. Group sessions also trained participants in the concepts of peer and public health advocacy (Brown, 1991; Minkler, 1989), persuasive communication techniques (Latkin, Forman, Knowlton, & Sherman, 2003), safety in community intervention provision, and all components of the modular RAP Peer-delivered Intervention, as well as extensive role play and demonstration of how it was designed to be delivered (Weeks et al., 2006). Staff confirmed PHA knowledge and comprehension of the primary information through role play and re-enactments. Training of PHAs using this curriculum occurred in 28 cycles, with 3–7 PHAs in each cycle, over a period of two and a half years (December 2001 – August, 2004). Additional details of the session goals and content are reported elsewhere (Weeks et al., 2006).

The basic training considered sufficient for a participant to be ready to provide the RAP Peer-delivered Intervention included completion of all sessions up to and including Session 5 (the first field session). At this staff-PHA partnered session, PHAs each had an opportunity to engage in intervention delivery to their peers in community settings. After completing Session 5, they received a certificate and an ID card with the title of Peer Health Advocate for use when conducting future RAP intervention in the community. PHA candidates who completed less than the four initial office sessions were not allowed to participate in the community sessions partnered with project staff (Sessions 5 through 10), although they were retained in the study for follow-up assessments.

The second-level of RAP intervention was the modular program PHAs delivered to their peers, called the RAP Peer-delivered Intervention. This required PHAs to engage recipients during each interactive encounter in at least two of three primary intervention components: 1) provision of prevention *education*, 2) *demonstration* of proper prevention practices, and/or 3) delivery of prevention *materials*. To improve fidelity of RAP peer intervention delivery, we provided each PHA with a field manual, called the RAP Flip-book, which illustrated and described each component of the prevention intervention. PHAs also received a backpack or bag to carry prevention materials with them when they went into the community to deliver the

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intervention or to keep with them whenever they interacted with other drug users, including in locations where they might also be using drugs. We also encouraged them to use the unique project slogans during intervention delivery (e.g., “Be aware, don't share, carry a spare”). We anticipated that these directives and supports would increase the potential impact of the intervention and the likelihood that recipients would retain the messages and be able to recall having been exposed to the RAP intervention in future interviews.

Key Measures for Outcome Analyses

We conducted behavioral and attitudinal risk assessments with all PHAs and their CRs at baseline (prior to the start of the PHA's training) and at 6 months post-baseline, regardless of their intervention participation. We also documented participation in or exposure to RAP and other prevention interventions between interviews through process tracking and on the post-intervention surveys. The baseline and follow-up assessment surveys were about one hour in length, for which participants were paid $25 at baseline and $30 at follow-up, with a $15 bonus for completion of the follow-up within two months after the 6-month scheduled appointment.

The baseline and 6-month surveys measured socio-demographic characteristics (sex, ethnicity, age, income, education level, employment and homeless status), drug use and sexual practices in the prior 30 days, health history (HIV, STI, hepatitis, drug treatment), attitudes regarding HIV prevention intervention delivery, exposure to RAP and other local interventions, provision of prevention to other drug users, adoption of bleach use to disinfect syringes (for injectors) or crack pipe rubber tips (for crack smokers–to avoid burns and lesions on the lips that facilitate transmission of infections), and an inventory of personal network members and their characteristics. All survey measures were translated into Spanish and back-translated into English to verify equivalence in the two languages.

Our primary drug-related behavioral risk variables for outcome analyses included the following behaviors reported for the 30 days prior to the interview: 1) number of times injected any drug; 2) times used a previously used needle/syringe; 3) times used drug solutions that had been measured in or drawn up into somebody else's used syringe; 4) times bleached used syringes; 5) times shared drug cookers, cottons or rinse water; 6) times used crack cocaine; and 7) use of rubber tips on crack pipes in the last 6 months. The primary sex-related behavioral risk outcome variables reported for the prior 30 days included: 1) number of sex partners; 2) number of unprotected sexual encounters; and 3) times unprotected sex with primary and non-primary sex partners, in exchange for crack or other drugs or money, or with a drug injector or crack smoker.

Relevant attitudinal factors used in these outcome analyses included a “PHA efficacy scale,” a 15-item set of questions about beliefs regarding the potential community and peer response and their own attitudes toward the idea of an active drug user providing HIV intervention in the community (with responses on a 4-point Likert scale from 1 = strongly disagree to 4 = strongly agree). Examples of scale items included positive outcomes (“You can help drug users reduce their risk of HIV,” “You feel comfortable talking to strangers about not sharing their works”) and negative expectations (“There's not much drug users can do to stop the spread of AIDS in their community,” “If you were to talk to drug users about AIDS they would think that you have the virus”). The internal reliability of the scale with the RAP sample is acceptable; Cronbach's $\forall = 0.72$ for the baseline sample and $\forall = 0.80$ for the 6-month sample.

We created several measures of intervention exposure for the two levels of RAP interventions (PHA training curriculum, RAP Peer-delivered Intervention). For the RAP PHA training exposure, we used the number of training sessions the PHA completed. With this measure, we were also able to create grouping variables, such as dichotomizing PHA recruits into untrained PHAs, including non-starters (0 sessions) and drop-outs (1–4 sessions), as well as trained PHAs

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(completed 5–10 sessions). For the purposes of this paper, we refer only to those who completed five or more sessions as PHAs; the rest when referenced are called untrained PHAs. While participation in one to four office sessions constitutes a potentially significant intervention in itself, the field training sessions provided a qualitatively different experience, based theoretically on the concept of community engagement for empowerment and change (Brown, 1991; Ramirez-Valles, 2002), which did not occur in the earlier sessions. The focus of RAP outcome analysis was on the diffusion, peer influence, and advocacy effects possible only through the community intervention initiated during training Session 5. Still, because of the potential effect of receiving any of the office sessions on risk reduction for those participants, we also distinguished between PHAs who had received no training sessions and those who had received any of Sessions 1–4.

Outside of the partnered training sessions observed by project staff, we generally could not directly observe, track or document all of the intervention PHAs delivered to their contacts, including to the CRs they referred into the study and to other PHAs who were members of their personal networks. We therefore used several measures to assess exposure to the RAP Peer-delivered Intervention, including asking directly about reported behavior change in association with receiving the RAP PHA-delivered intervention, and indirect measures that indicated exposure, described below.

As a direct measure of exposure to the peer intervention, we asked specifically about behavior changes in the prior 6 months that the participant made “as a result of talking to someone from RAP” (clarified as an active drug user who carried a backpack with prevention materials, had a Flip-book or RAP hat or sweatshirt, slogan buttons, etc.). This 13-item list of risk and harm reduction practices included condom use, decrease in number of sex partners, syringe cleaning or cessation of equipment sharing, decrease in drug use, and talking to other drug users about HIV or other health issues, among other practices.

However, because many CRs were not familiar with the project name, nor did they always realize that the person who referred them into the study was their PHA, we asked about receipt of prevention information, materials, or demonstration of prevention practices from “an active drug user in the last 6 months,” including from “someone you know,” “a stranger,” and “in the place you usually use drugs.” We also asked about sources, in the prior 6 months, of reading materials, prevention materials other than condoms, and condoms, including from “someone from the RAP project.” To assess exposure to elements specific to the RAP intervention (components not provided by any other local prevention efforts), we asked about recognition of the PHA Flip-book, and whether the participant had heard any of the six RAP project slogans. These were used as confirmatory measures, since PHAs may have used these intervention tools intermittently or inconsistently. Additionally, RAP Peer-delivered Intervention (i.e., health promotion) was indirectly measured by asking all participants (PHAs and CRs) whether they had talked with other people about HIV prevention or health related issues (a 14-item list) in the prior two weeks. Finally, in the personal network component of the survey, we asked whether they had *received* prevention information or materials in the prior 6 months from any member listed in their social network, and also whether they had *provided* that person with prevention information or materials in the prior six months. Furthermore, to the degree that it could be confirmed, we documented whether each of the people named in each participant's social network was a PHA or CR in the project. We asked all RAP participants the same questions regarding exposure to the RAP Peer-delivered Intervention on the assumption that anyone in the study, including PHAs and those who dropped out or never initiated the training, could have received intervention from an active PHA, and recognizing that CRs might begin to mimic the work of the PHAs over time.

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To assess additional potential community influences that may have affected participants' reported intervention exposure or behavior change between baseline and follow-up interviews, we measured use of community services and other prevention interventions during the same time period. We also used community ethnography to document other non-RAP interventions going on with drug users in Hartford throughout the study period and changes in community service availability and activity. In the survey, we documented non-RAP intervention exposure in the community as: 1) use of the Hartford Needle Exchange Program; and 2) receipt of prevention information, condoms, and/or other prevention materials from other local HIV and health or service organizations. Additionally, we tracked changes in reported utilization of non-RAP local prevention services at baseline across the two and a half years of project intake to look for unexpected changes in the community environment during the project period that might have affected outcomes.

FINDINGS

Sample and Comparison Group Characteristics at Baseline and Attrition Assessment

The recruitment and referral process resulted in a study sample of 523 who completed the baseline survey, including 176 PHA candidates and 347 of their contacts. Of the 176 PHA candidates, 112 (63.6%) completed the first five training sessions to become trained PHAs. They referred 223 CRs into the study. Additionally, 64 PHA candidates recruited into the study either never initiated the training program (n=55, 33.3%) or completed only 1–4 sessions (n=19, 10.8%). These untrained PHAs referred an additional 124 CRs into the study.

For analyses of baseline equivalence, we retained the distinction between four groups (trained PHAs, CRs of trained PHAs, untrained PHAs and the CRs of untrained PHAs). However, in conducting tests of behavioral, attitudinal, and other change between baseline and follow-up of the returned sample to assess RAP intervention outcomes, we generally used three comparison groups: trained PHAs, CRs of trained PHAs, and the rest of the sample, referred to as “Others.” This latter group included all others referred into the study as CRs and all those recruited as PHAs who never initiated the training, but it excluded ten PHA candidates who returned for the follow-up survey who attended any of training Sessions 1–4. Excluding these ten PHAs who dropped out before Session 5 allowed us to make a greater distinction between those PHAs who received both first level (staff-delivered) and possibly also second level (PHA-delivered) intervention, from those who received only second level intervention from the trained PHAs.

It is important to note that all participants in the project, including trained and untrained PHAs and all CRs, could potentially have been contacted by a trained PHA in their network between baseline and 6-month assessments, given the close geographic proximity of the neighborhoods in which Hartford drug users live and move and the known close network connections among drug users across the city (Weeks et al., 2002). The diffusion aspect of the design indicated that this would indeed occur. We therefore did not use the group of “Other” participants as a non-intervention comparison group. Instead, we treated the members of this group as potential recipients of the second level PHA-delivered intervention.

Demographic and health characteristics at baseline of comparison samples are indicated in Table 1. We tested baseline differences among the four comparison groups on demographic characteristics, drug and sex risks, PHA efficacy attitudes, and risk reduction practices reported at baseline. Analysis of baseline equivalence on key characteristics indicated few significant differences among groups, with some important exceptions. Although we over recruited women to be PHAs at intake, both male and female PHAs tended to recruit male CRs, thereby generating a total CR sample that had fewer than expected women. Thus, there is a statistically significant difference in the percentage of women PHAs compared to CRs. However, the total

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sample reflected a gender ratio similar to that in previous Hartford studies, which indicated street-recruited drug users to be about 25% women (Singer & Weeks, 1992;Weeks et al., 2001;Weeks et al., 1996). The sample also included four individuals who self-identified as transgender. There were virtually no differences between PHA recruits and CRs by ethnicity; however, significantly more African Americans than Hispanics or non-Hispanic Whites and other ethnic groups completed the PHA training.

PHAs and CRs did not differ significantly by socio-economic characteristics of educational attainment, employment status, income, and homeless status at baseline. All these indicators showed significant poverty and poor economic prospects in the study sample. In health and treatment histories, more trained PHAs reported having a history of STI and HIV, and more untrained PHAs reported having had hepatitis C. There were no significant differences among comparison groups in recent drug treatment history, including use of detoxification, in-patient, or outpatient programs.

Baseline differences in drug use in the prior thirty days between trained and untrained PHA groups were statistically significant (more PHAs who completed the training were crack users, more untrained PHAs were frequent injectors), but differences in their general sexual risk behaviors were not significant (Table 2). We also found differences in baseline PHA efficacy scale scores, with all PHA candidates (trained and untrained) averaging higher scores than CRs, and PHAs who completed the training entering the study with the highest baseline scores on their beliefs about the potential effectiveness of drug users to bring about risk and harm reduction in their communities and with their peers ($p < .001$).

We were able to relocate and interview 367 (70.2%) of all RAP participants for the 6-month follow-up assessment. Our tracking records indicated that those lost to follow-up included 10 incarcerated, 11 who moved out of the area, 2 in residential drug treatment, and 2 who had died; the rest had unknown reasons for attrition. Those who returned included 134 (76%) of all original PHA recruits and 233 (67%) of all original CR referrals. However, differences in retention among the study subgroups was significant ($p<.001$), with 87.5% of trained PHAs (n=98) and 70.7% of their CRs (n=157) returning for the 6-month survey, compared to 56.3% of PHAs who completed less than 5 training sessions and 61.3% of the CRs of untrained PHAs. We compared baseline demographic and risk characteristics of the follow-up sample with the sample lost to follow-up to look for attrition bias. This included comparisons by sex, ethnicity, age, homeless and employment status, drug use (types and amount), and sex risk (number of partners and unprotected sex) in the prior 30 days. No significant differences were found between the retained and lost samples in sex, ethnicity and baseline risk characteristics. However, those lost to follow-up were more likely at baseline to have been homeless, unemployed, and younger.

PHA Exposure to Intervention

A quarter (25.6%) of the 176 PHAs recruited and interviewed at baseline never initiated the training program, either because they did not successfully refer two CRs (n=16) or they did not arrive at the scheduled training start date (n=29). Additionally, 19 PHA candidates (10.8%) who started the training program dropped out before completing the five sessions needed to become fully trained PHAs. In addressing the “intent to treat” question for the RAP PHA training curriculum, we found that those who did not initiate or who completed less than five sessions tended to be heavy injection drug users (Table 2), for whom an intensive training program such as RAP's PHA curriculum may have presented too great a burden. However, retention in the PHA training of those who initiated the program was very high; 86% (n=112) who started the program completed five sessions to become trained PHAs, and 51% (n=66) of those who started completed all 10 sessions over a three month period (Weeks et al., 2006).

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Changes in Behaviors and Attitudes Between Baseline and Follow-up

Overall Risk Reduction in the Total Sample: Hypothesis 1—We compared baseline and 6-month follow-up data of all participants who completed both surveys (n=367) to assess changes in reported risk behaviors between these time points. Table 3 indicates significant reduction in the percentage of all returned RAP study participants who reported engaging in injection drug use and sharing syringes, crack use, and non-injection opiate, cocaine and amphetamine use, increased rubber tip use among crack users, and reduction in all sexual risks. The percent of injectors who shared equipment (cookers, cotton, rinse water) and drug solutions also decreased by 29% and 42%, respectively, though this was not statistically significantly. Bleach use is not included in Table 3 because few RAP participants reported using it. When indicating having used a syringe that had previously been used by someone else, 13 out of 26 at baseline and 6 out of 11 at follow-up said they used bleach.

In addition to a reduction in the percentage of the sample who reported engaging in risk behavior at follow-up, we also found a significant reduction in frequency of drug and sex risk incidents (Table 4), including injection rates and times used crack cocaine in the prior 30 days, as well as the number of unprotected sexual encounters overall and with non-primary (e.g., casual and/or paying) partners. We also found notable reductions in the rate of injection equipment sharing, non-injection heroin, cocaine and/or amphetamine use, and number of unprotected sexual encounters with an IDU.

Risk Reduction among Comparison Groups: Hypothesis 2—We assessed risk reduction outcomes among the study comparison groups by looking at categorical change from baseline to follow-up in reported prior 30 day behaviors comparing trained PHAs, their CRs, and the “Others” (excluding the ten retained participants who attended PHA training Sessions 1 – 4, as noted above). Table 5 gives percentages of participants who maintained no risk, reduced, or ceased risk. A high percentage of participants in each of the three comparison groups reduced or ceased each of the drug and sex risk practices or maintained low risk, though there is evidence that some participants initiated or increased risk during the test period. On nearly all measures, PHAs indicated the best outcomes, followed by their CRs, and then Others. However, statistical comparisons of these data did not support our hypothesis that PHAs, who received level one intervention (5–10 intensive staff-delivered sessions in the RAP PHA training) and possibly also level two intervention from another trained PHA, would show significantly better outcomes than study participants who were only potentially exposed to level two intervention (the PHA-delivered program). CRs and Others reported nearly the same risk reduction as each other, and both groups came close to the risk reduction or low-risk maintenance of the PHAs. Comparing PHAs with both of the other groups combined indicated that the only significant difference was in having ceased/reduced unprotected sex in exchange for money/drugs ($p<.05$). When Others were removed from these analyses, reducing number of sex partners also varied significantly ($p<.05$) in the comparison between PHAs and their CRs. This lack of significant difference across participant types held with analysis of risk incidents as well (data not shown).

We conducted several types of analysis to explore reasons for this lack of difference in outcomes by comparison groups. These included: a) assessing RAP intervention exposure and RAP influence in all comparison groups, b) exploring evidence of diffusion of intervention effects from PHAs to CRs and to Others, and c) changes in the urban environment that may have affected the whole sample outside of RAP influence.

RAP Intervention Exposure and Influence

Several indicators of exposure to the level two RAP Peer-delivered Intervention are presented in Table 6. While some of these are direct indications of exposure to the peer intervention (e.g.,

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recognition of the RAP Flip-book and slogans and receipt of reading materials, condoms and other prevention materials from “someone from the RAP project”), others are indirect (e.g., receiving prevention information, demonstration or materials from “any other drug user” and talking with other drug users about HIV and other health issues). As mentioned above, these latter were necessary measures because some study participants may not have been clearly aware of the RAP project nor able to identify the PHAs.

These data revealed some important indicators of PHA delivery of the RAP peer interventions. For example, receiving reading materials, condoms and other prevention materials from someone in the RAP project increased significantly between baseline and follow-up for the total sample. Differences at baseline between PHAs and the other two comparison groups were significant in these measures ($p<.05$) and remained so at follow-up for reading materials and condoms. However, by follow-up the difference between PHAs and both of the other comparison groups in reporting RAP as a source of other prevention materials (i.e., bleach kits and crack health kits) was no longer significant, suggesting that these groups had caught up with PHAs in receiving prevention materials from someone in RAP.

Likewise, receipt of prevention interventions from “another active drug user” (most of whom were someone the participant knew) was significantly different among comparison groups at baseline, but by follow-up was no longer significant between PHAs and their CRs. Differences in this measure at follow-up between Others and the PHAs and CRs remained significant ($p<.05$), though the increase from baseline to follow-up within this group was also significant, suggesting that the group of Others had also been exposed to the RAP intervention. This was confirmed with the measure of recognition of the RAP Flip-book and the slogans, with the greatest recognition indicated by CRs, but also significant recognition among Others in the study sample. Reported having talked with drug users about HIV and other health issues likewise pointed to significant change in the behaviors of all drug users in the study, including CRs and Others, which was sustained even up to two weeks before the follow-up survey.

To assess the relationship between exposure to RAP interventions and the positive outcomes reported by all comparison groups in the study, we analyzed responses to a direct question asked at follow-up regarding changes participants had made in the prior 6 months “as a result of having talked to someone in the RAP project” (specified as a PHA or a drug user handing out materials from a backpack, not project staff). Table 7 confirms the strongest reported risk reduction in most measures associated with talking to a PHA was among the PHAs themselves, followed by their CRs, and then Others. However, only reduction in drug use, adoption of rubber tips on crack pipes, reduction in sharing cookers, and reduction in number of sex partners as a result of talking to someone from RAP varied significantly by participant type, with PHAs reporting better outcomes on these items than either of the other two groups. Additionally, the two health promotion measures differed significantly among groups, with more PHAs reporting having talked to other drug users about HIV prevention and other health issues (i.e., the work of a “Peer Health Advocate”). This pattern points to interaction among the PHAs themselves, as well as potential PHA contact and influence over both the CRs and Others in the study.

Another indicator of RAP project influence was the PHA efficacy scale, which measured participants' belief in the ability of active drug users to influence their peers to reduce risk and to have a positive impact on their community. All groups' scores increased between baseline and follow-up from a mean of 2.73 to 2.78 (scale of 1 = low efficacy beliefs to 4 = high efficacy beliefs), though PHAs' mean score increased by 3.69% (from 2.85 to 2.95), compared to CRs', which increased 1.38% (from 2.68 to 2.72), and Others', which increased 0.48% (from 2.70 to 2.71). Repeated measures ANCOVA indicated significance in both the time effect (baseline to follow-up, $p=.001$) and group effect (differences among comparison groups, $p=.000$), though

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not in the interaction between time and group (each group's change pattern over time, p=.059). We also found a significant correlation (p<.05) between follow-up PHA efficacy scale score and reported reduction in prior 30 day unprotected sex, number of sex partners, and drug use, and reported increase in use of rubber tips and having talked to other drug users about HIV or other health issues as a result of having interacted with a PHA.

Indication of RAP Intervention Diffusion Through Networks

As a first step in assessing RAP intervention diffusion, we sought to locate PHAs in the personal networks of study participants. Through an intensive review of the name lists generated in the network component of the survey and confirmed through street outreach and ethnographic observation, we identified trained PHAs and their CRs who were named on the lists of other participants. We then compared the mean number of PHAs and CRs named by members of each of the study subsamples at follow-up (Table 8). As expected, CRs were the most likely to name one or more PHAs in their personal networks, and PHAs were the most likely to name one or more CRs. However, it is also notable that the group of Others also named both PHAs and CRs, suggesting significant mixing of participants who were directly exposed to RAP intervention, and potential for diffusion of the intervention materials and effects beyond the PHAs and their own recruited CRs.

We also compared the groups in terms of the percent of network members to whom participants gave information, materials or demonstrations, and the percent of their network members from whom they received these, including at their primary drug use site (Table 8). Differences among comparison groups were significant for giving prevention information and for giving materials/demonstration to network members (p<.001 for both), as well as for receiving materials/demonstrations from network members (p<.05), including at the participant's primary drug user site (p<.001). In all cases, PHAs gave prevention to the highest percentage of network members, followed by their CRs. CRs received prevention materials from the highest percentage of network members, followed by Others. However, at the primary drug use site, CRs, followed by PHAs themselves, received prevention from the highest percent of their network members. Notably, differences were not significant across comparison groups for receiving HIV prevention information from network members (p=.082), suggesting similarity among subgroups in the degree to which network members were sharing information with each other.

To confirm the activities of the Peer Health Advocates, we conducted analyses to assess the correlation between presence of a PHA in the participant's personal networks and receiving or giving out prevention materials and information. We found a correlation at follow-up between number of PHAs in the network and having received prevention information, materials or a demonstration from another active drug user in the last 6 months (n=365, Pearson r = .21, p=.001). When PHAs themselves were excluded from these analyses, the correlation remained significant (n=267, Pearson r = .22, p<.01). We also found a correlation between the number of PHAs in the network and having received prevention in the participant's primary drug-use site at follow-up (n=365, Pearson r = .12, p<.05). However, when PHAs were excluded from these analyses, the correlation was no longer significant (n=241, Pearson r = .12, p=.101).

Non-RAP HIV Prevention and Community Changes During the Intervention Study Period

Both PHAs and CRs also used other HIV prevention services in the city prior to the baseline RAP interview as well as during the period between the baseline and 6-month surveys. We initially built into this study measures of exposure to other community interventions to look for potential confounders in the assessment of RAP intervention outcomes. However, it appears that use of these services in itself was potentially influenced by RAP intervention exposure.

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In the 2½ year period during which we conducted RAP baseline surveys, ethnographic and outreach observations of service availability documented that there were no new service programs initiated and no other major outreach interventions going on in the city concurrent with the RAP study. We also examined the potential correlation between time enrolled in the study and having "received HIV prevention information from any other programs, agencies or institutions," "received any materials concerning HIV or AIDS," "received any HIV prevention materials other than condoms," and "received any condoms" in the last 6 months from local prevention or health care agencies and programs. Most of the Pearson coefficients were very small and not statistically significant except for negative correlations between time enrolled in the study and having received any condoms from the Hartford Needle Exchange Program (NEP), from an AIDS service organization, and from a social service program (Pearson r = −.119, −.116, −.094; p= .006, .009, .036, respectively). However, participant use of existing prevention services increased significantly from baseline to 6-month in the total sample ($p<.05$), and among CRs ($p<.05$). This suggests that participants, especially CRs, were making greater use of existing services in the period prior to their follow-up interviews than they had been before the baseline. This explanation was confirmed in a focus group with PHAs, in which they suggested that both they and their contacts were making decisions to take greater advantage of these services after being exposed to the health advocacy work of PHAs or the RAP training.

DISCUSSION

The RAP intervention diffusion model was designed to affect the environment of risk among Hartford drug users by mobilizing the whole network through the initial efforts of some. Findings from the baseline/follow-up assessments indicated that training members of the drug using community to be Peer Health Advocates set in motion a process of change triggered by their leadership, their distribution of prevention materials and information, and their modeling of health promotion advocacy and prevention practices among their peers. Evidence suggests that not only did PHAs take up the challenge and carry the intervention to their drug using network members and others in their community, but they also supported and reinforced each other's efforts to continue to do so, and even motivated some who did not receive the PHA training to mimic these efforts as well. Thus, once set in motion, the intervention seems to have a feedback mechanism that carries it forward in time and through the network.

Outcome analyses indicated that, as a population-level intervention, RAP initiated a "sea change" in attitudes about positive drug user influence and in reduced risk in normative drug use and sexual behaviors. This change was evident across all study participant groups, regardless of role in the project, types of drugs used, and sexual practices. This impact was greater than anticipated, affecting nearly all areas of HIV risk. Of particular note was the reduction in overall drug use, often leading to drug cessation, especially among PHAs, though challenges in affecting the heaviest drug injectors and eliminating certain drug-sharing practices appear to remain. The reduction in the overall drug risk was confirmed ethnographically among PHAs as directly related to participation in the training and through the process of health and harm reduction promotion with their peers (Dickson-Gomez et al., 2006). The size of the impact of both the first level and second level RAP interventions suggests great potential for effecting long-term HIV, hepatitis and STI risk reduction among members of the network.

The lack of significant difference in risk reduction across study comparison groups in many of the outcome indicators at follow-up was an unexpected finding. The direct impact of the intensive RAP Curriculum on PHAs is evident in these and earlier analyses (Weeks et al., 2006). However, the 5–10 session staff-delivered intervention, on the one hand, and the PHA-delivered peer intervention on the other, the latter of which occurred on an unknown number

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of occasions with peers in various community locations, while not equivalent, had similar beneficial effects. That the PHAs did deliver the RAP peer intervention was evident; the significance of this was suggested by the risk reduction associated with exposure indicators and the elimination of significant differences in key measures observed at baseline in all comparison groups by the time of the follow-up assessment. Presence of PHAs and CRs in participants' personal networks across comparison groups, including PHAs interacting with other PHAs, confirmed the significant mixing of drug users in Hartford and the positive feedback supporting prevention and continued health promotion and advocacy, making possible the exposure of others to the intervention. This reaffirms the value of supporting a peer-delivered intervention within the networks of populations at risk. Further, the lack of significant differences in outcomes across study comparison groups does not appear to have resulted from use of other social services in Hartford; rather, the increased utilization of those services from baseline to 6-month follow-up appears to have been triggered by the efforts of the PHAs to encourage improving health knowledge and increasing use of available prevention resources.

Testing the efficacy and diffusion of this peer-delivered intervention presented significant methodological challenges. A randomized control design was obviated by the expectation that the control group would become contaminated through intervention diffusion. Further, funding limitations, the complexity of the network evaluation design, and the potential significant influence of local community-level variations on outcomes over time precluded using drug users in another city as a control population in this study. As a result, the study lacks a non-intervention group for outcome comparisons with the RAP sample subgroups. As anticipated, network connections among drug users resulted in significant apparent exposure of the Other participants (untrained PHAs and their CRs) to the RAP Peer-delivered Intervention. While this was a desired outcome, we were not able to document systematically the process through which this occurred because it could happen at any time and in any location. Thus, we relied on the three-tiered comparison that assumed PHAs, with known RAP intervention exposure, as tier one, their self-referred CRs, with known connection to a PHA, as tier two, and all other participants (excluding partially trained PHAs), with unknown connections to both of the other groups, as tier three for intervention comparison purposes. Exclusion of the partially trained PHAs allowed a clearer distinction between those who received level one (staff-delivered) intervention and those whose only exposure to RAP was level two (PHA-delivered) intervention.

A second design challenge derives from the recruitment procedures, which may potentially limit generalizability of the study findings. Neither the PHA nor the CR samples were recruited to be representative of the drug-using population in the city, given the special eligibility criteria for PHAs and the single-tier network referral method from PHAs to CRs. However, the PHA sample was designed to represent a targeted special group characterized by high likelihood to initiate and continue peer health advocacy work and to influence their peers; it is expected that replication of the RAP intervention would require seeking a similar target population to train as PHAs. Also, while the referral system we used to recruit CRs may have resulted in omission of PHA network members with whom the PHAs have less influence, as well as more isolated drug users outside the PHAs' networks, it facilitated our ability to document PHA intervention delivery to some measurable portion of their drug using networks. Additionally, the diffusion effect increased the likelihood that peer influence might reach even those more isolated, socially distant drug users, outside the immediate referral group of the PHAs, as well as those in more dire circumstances, such as heavy injectors who could not succeed as PHAs.

A third methodological challenge was that we could measure level two RAP peer intervention exposure only through indirect means. The difficulty that study participants had in identifying PHAs meant we could not simply ask whether a PHA had contacted them, but had to rely on

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other indications that a drug user providing intervention was indeed a RAP-trained PHA. Also, the potential for various (including incorrect) interpretations of our indirect indicators of the RAP intervention components (i.e. someone from RAP project) and RAP delivery may increase the likelihood that some intervention exposure was missed (Type 2 error) or over represented (Type 1 error). We minimized this by using multiple independent measures for confirmation of less specific indicators to verify reported exposure and confirm its relation to measured changes.

Despite these design and measurement challenges, analysis of RAP outcomes showed the program to have great promise. For example, while not a primary outcome of the study, improved attitudes of PHA efficacy confirmed successful implementation of the RAP interventions and recognition of its positive impact on the drug using and broader communities. This was confirmed with the ethnographic data that indicated significant positive role change among PHAs, including a new definition of self as harm reduction model and advocate, and a new recognition by other drug users as a prevention resource (Dickson-Gomez et al., 2006; Weeks et al., 2006). The increase in efficacy beliefs among PHAs was expected. However, the significantly higher scale scores at follow-up among their CRs and others in the study suggests a change in these participants' perception of PHAs' influence in the broader community of drug users. Though we cannot make a direct connection between this change in attitude and their exposure to the PHA-delivered intervention, the significance of the difference suggested that attitudes toward PHA work among the comparison groups might have improved as a result of observing PHAs conducting this work, and their recognition of the influence PHAs were able to have on others to reduce risk through these efforts. The consistent and repeated patterns among the multiple indicators of RAP intervention delivery and exposure, and the apparent influence of this exposure on all study participants, reinforced the conclusion that training active drug users to become health advocates among their peers is highly effective for reducing drug- and sex-related HIV risk behaviors among drug using networks.

RAP further showed promise for modifying peer norms and attitudes regarding the importance of risk and harm reduction, and increasing admiration for and modeling of those who conduct peer health advocacy for community health enhancement. It became clear in this study that CRs did indeed begin to mimic the work of the PHAs and deliver health messages and prevention materials to others as well. The degree to which this occurred was unexpected and suggests diffusion of RAP intervention on two levels, including, on the one hand, secondary distribution of prevention materials by CRs using PHAs as a source, and on the other, diffusion of the modeled behavior to deliver prevention messages and support and to advocate for health among peers. Ethnographic data from the field observations and in-depth interviews with CRs confirmed this process (Dickson-Gomez et al., 2006). Further study of the degree to which secondary distribution and PHA behavioral replication occurs is needed to assess the full effect of the peer training programs.

The apparent efficacy of the RAP Peer-delivered Intervention has implications for sustainability of effect and long-term availability of prevention support for drug users, given the presence of PHAs at critical times of need when community services are frequently not available, and their relatively long-term ties to many of their network members, even if the PHA ceases using drugs. However, this requires ongoing support of PHAs to continue their efforts, including at a minimum a continued supply of prevention materials for them to distribute, and more likely, additional ongoing support to sustain their commitment and motivation to continue. Further study is needed on requirements for the sustainability of peer health advocacy work among drug users.

Presence of a PHA in a drug user's network was a primary predictor of positive behavioral outcomes. It is likely to result in repeated and long term exposure to prevention messages,

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encouragement and support, as well as provision of materials and demonstration of their proper use. However, some who ceased using drugs as a result of going through the PHA training program eventually reduced their interaction with active drug users in order to maintain their sobriety. Thus, sustainability of programs like RAP also requires ongoing training of new PHAs who will continue to disseminate prevention messages and materials to drug-using network members, as well as to others within their neighborhoods and their city.

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Table 1

Baseline Demographics and Health Characteristics of the RAP Sample (percentages except where indicated)[a]

			Others		
	PHAs	**CRs**	**Untrained PHAs**	**CRs of untrained PHAs**	**Total Sample**
Total Sample at Baseline	**n=112**	**n=223**	**n=64**	**n=124**	**n=523**
Sex: Female **	37.5	22.5	29.7	16.1	25.1
Ethnicity: **					
African American	55.4	51.4	32.8	31.5	45.2
Puerto Rican/Other Hispanic	40.2	39.6	48.4	56.5	44.8
Non-Hispanic White/Others	4.5	9.0	18.8	12.1	10.0
Mean age (range 18–67)	M=39.99	M=40.42	M=39.53	M=39.05	M=39.89
Socio-Economic Status:					
Less than high school or GED	58.1	48.7	45.3	61.3	53.3
Unemployed	78.6	75.1	82.8	70.7	75.8
Homeless at baseline	48.2	48.6	49.2	52.4	49.5
Health history:					
Ever diagnosed with an STI *	45.9	38.6	35.9	26.6	36.9
Has Hepatitis C *	80.9	64.9	91.7	82.1	76.1
Has HIV *	24.0	14.4	17.7	10.6	16.0
Any drug treatment in last 6 m	34.7	30.2	40.6	31.5	32.8

[a] Significance is calculated in differences across four participant types at baseline assessment.

* $p < .05$;

** $p < .001$

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Table 2

Baseline Risk Characteristics and Attitude Scores of RAP Participants (percentages except where indicated)[a]

			Others		
	PHAs	**CRs**	**Untrained PHAs**	**CRs of untrained PHAs**	**Total Sample**
Total Sample at Baseline	**n=112**	**n=223**	**n=64**	**n=124**	**n=523**
Drug risk in prior 30 days:					
Injected any drugs *	41.1	33.3	54.7	41.1	39.5
Used previously used syringe	15.2 [b]	21.9 [b]	28.6 [b]	17.6 [b]	20.5 [b]
Shared injection works/rinse water	37.8 [b]	24.3 [b]	40.0 [b]	25.5 [b]	30.2 [b]
Used shared drug solution	15.9 [b]	20.3 [b]	20.6 [b]	13.7 [b]	17.7 [b]
Smoked crack *	67.9	61.3	64.1	48.0	59.9
Used rubber tips on crack pipe *	33.3 [c]	15.4 [c]	25.6 [c]	20.3 [c]	21.8 [c]
Used non-injection opiates/cocaine/ amphetamines	35.7	36.5	39.1	43.5	38.3
Sexual risk in prior 30 days:					
Multiple sex partners	32.1	29.7	25.0	31.5	30.1
Any unprotected sex	36.0	35.8	39.1	34.7	36.0
Unprotected sex…					
with a primary partner	26.4 [d]	26.6 [d]	28.1 [d]	29.8 [d]	27.5 [d]
with a non-primary partner	13.6 [d]	12.4 [d]	15.6 [d]	9.7 [d]	12.4 [d]
while exchanging sex for $/drugs	8.2 [d]	6.4 [d]	7.8 [d]	7.3 [d]	7.2 [d]
with an IDU	6.4 [d]	4.6 [d]	10.9 [d]	9.7 [d]	7.0 [d]
with a crack cocaine user	21.1 [d]	18.4 [d]	17.2 [d]	8.9 [d]	16.6 [d]
PHA Efficacy Scale score (mean) [e]**	M=2.841	M=2.673	M=2.773	M=2.654	M=2.718

[a] Significance is calculated in differences across four participant types at baseline assessment.

[b] Calculated as percent of participants who injected at baseline as follows: PHA=46; CR=73; untrained PHA=35; CR of untrained PHA=51, total sample=205.

[c] Calculated as percent of participants who smoked crack at baseline as follows: PHA=76; CR=136; untrained PHA=41; CR of untrained PHA=59, total sample=312.

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[d] Calculated as percent of participants who had any unprotected sex at baseline as follows: PHA=110; CR=219; untrained PHA=64; CR of untrained PHS=124, total sample=517.

[e] Mean score on a 15-item Likert scale, with responses ranging from 1 = strongly disagree to 4 = strongly agree. Negative items were reverse coded for analysis.

* $p < .05$;

** $p < .001$

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Table 3

Percent of RAP Participants Reporting Risk Behaviors in Prior 30 Days at Baseline and 6-month Follow-up (participants who completed both measures, n=367)

	Baseline	6-month	p
Injected drugs	40.1	27.8	**.000**
Used previously used needle/syringe [a]	22.8	9.8	**.027**
Shared injection equipment [a]	26.4	18.7	.138
Shared drug solution from other's syringe [a]	20.9	12.1	.232
Used crack	59.4	45.0	**.000**
Used rubber tips on crack pipes [b]	23.0	71.1	**.009**
Used other non-injection opiates, cocaine or amphetamines	35.7	21.5	**.023**
Any drug treatment in prior 6 months	32.7	47.7	**.000**
Had multiple sex partners	29.0	21.1	**.000**
Had any unprotected sex	35.3	28.3	**.000**
Unprotected sex with primary partner [c]	26.4	23.3	**.000**
Unprotected sex with non-primary partner [c]	12.6	4.5	**.000**
Unprotected sex in exchange for money/drugs [c]	6.7	4.8	**.021**
Unprotected sex with drug injector [c]	6.5	4.5	**.000**
Unprotected sex with crack smoker [c]	17.8	10.2	**.000**

[a] Calculated as percent of participants who injected at either baseline or follow-up who completed both surveys (n=92).

[b] Calculated as percent of participants who smoked crack at either baseline or follow-up who completed both surveys (n=152).

[c] Calculated as percent of participants who were sexually active at either baseline or follow-up (n=360).

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Table 4

Risk Behaviors in Prior 30 Days Reported at Baseline and 6-month Follow-up (Mean times reported by participants who completed both measures, n=367)

	Baseline	6-month	p
Times injected drugs (n=157) [a]	119.32	77.82	**.000**
Times used previously used needle/syringe [b]	6.75	4.15	.511
Times shared injection equipment [b]	30.33	10.35	.058
Times shared drug solution from other's syringe [b]	13.38	2.36	.129
Times used crack	89.52	61.50	**.024**
Times used other non-injection opiates, cocaine or amphetamines	18.86	12.79	.077
Number of sex partners	2.91	2.13	.145
Times had any unprotected sex	5.59	3.71	**.048**
Times unprotected sex with primary partner [c]	3.68	2.75	.232
Times unprotected sex with non-primary partner [c]	1.45	.23	**.017**
Times unprotected sex in exchange for money/drugs [c]	1.17	.56	.243
Times unprotected sex with drug injector [c]	1.28	.42	.075
Times unprotected sex with crack user [c]	1.45	1.19	.584

[a] Includes participants who injected at either baseline or follow-up who completed both surveys.

[b] Includes participants who injected at both baseline and follow-up (n=92).

[c] Includes participants who were sexually active at both baseline and follow-up (n=211).

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Table 5

Drug and Sex Related Risk Reduction or Low Risk Maintenance Among RAP Participants from Baseline to 6-month Follow-up, Prior 30 Day Reported Behavior (percentages who completed both surveys, n=367)

	PHAs (n=98)		CRs (n=157)		Others (n=102) [a]		Total (n=367) [b]	
	n	(%)	n	(%)	n	(%)	n	(%)
Non-injector at baseline:	(59)	(60.2)	(102)	(65.0)	(53)	(52.0)	(220)	(59.9)
Remained non-injector at 6-mo.	58	98.3 [c]	97	95.1 [c]	50	94.3 [c]	210	95.5 [c]
Injector at baseline:	(39)	(39.8)	(55)	(35.0)	(49)	(48.0)	(147)	(40.1)
Ceased all injection at follow-up	18	46.2 [d]	14	25.5 [d]	22	49.9 [d]	55	37.4 [d]
Ceased or reduced injection rate	30	76.9 [d]	40	72.7 [d]	37	75.5 [d]	109	74.1 [d]
Ceased or reduced sharing syringes or continued non-sharing	38	97.4 [e]	54	98.2 [e]	45	91.8 [e]	141	95.9 [e]
Ceased or reduced sharing injection works or continued non-sharing	36	97.3 [e]	49	89.1 [e]	44	89.8 [e]	133	91.7 [e]
Ceased or reduced sharing drug solutions or continued non-sharing	35	94.6 [e]	50	90.9 [e]	46	93.9 [e]	135	93.1 [e]
Non-crack user at baseline:	(33)	(33.7)	(61)	(38.9)	(51)	(50.0)	(149)	(40.6)
Remained non-crack user at follow-up	31	93.9 [f]	51	83.6 [f]	39	76.5 [f]	123	82.6 [f]
Crack user at baseline:	(65)	(66.3)	(96)	(61.1)	(51)	(50.0)	(218)	(59.4)
Ceased all crack use at follow-up	28	43.1 [g]	32	33.3 [g]	18	35.3 [g]	79	36.2 [g]
Ceased or reduced rate of crack use	47	72.3 [g]	68	70.8 [g]	31	60.8 [g]	149	68.3 [g]
Initiated or increased use of rubber tips	29	70.7 [h]	38	56.7 [h]	21	63.6 [h]	90	61.2 [h]
Sexually active at baseline:	(75)	(76.5)	(112)	(72.3)	(72)	(70.6)	(266)	(72.9)
Reduced number of sex partners	38	50.7 [i]	36	32.1 [i]	34	47.2 [i]	112	41.7 [i]
Ceased or reduced all unprotected sex or continued no unprotected sex	55	74.3 [i]	81	73.6 [i]	59	81.9 [i]	200	76.3 [i]
Ceased or reduced unprotected sex with primary partner	55	75.3 [i]	84	76.4 [i]	59	83.1 [i]	198	78.0 [i]
Ceased or reduced unprotected sex with non-primary partner	73	100.0 [i]	103	93.6 [i]	69	97.2 [i]	251	96.5 [i]
Ceased or reduced unprotected sex in exchange for money/drugs*	73	100.0 [i]	101	91.8 [i]	67	94.4 [i]	247	95.0 [i]

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	PHAs (n=98)		CRs (n=157)		Others (n=102) [a]		Total (n=367) [b]	
	n	(%)	n	(%)	n	(%)	n	(%)
Ceased all sexual activity	18	24.0 [i]	19	17.0 [i]	18	25.0 [i]	55	20.7 [i]

[a] Includes 76 CRs of all untrained PHAs (i.e., those who attended 0–4 training sessions) and 26 PHAs who never started the training; PHAs who attended 1–4 training sessions are excluded from this group.

[b] Ten PHAs who attended only 1–4 sessions were included in the follow-up total.

[c] Calculated as percent of participants who were non-injectors at baseline.

[d] Calculated as percent of participants who were injectors at baseline.

[e] Calculated as percent of participants who were injectors at either baseline or follow-up.

[f] Calculated as percent of participants who were non-crack users at baseline.

[g] Calculated as percent of participants who were crack users at baseline.

[h] Calculated as percent of participants who smoked crack in the prior 6 months before both surveys.

[i] Calculated as percent of participants who had sex in the last 30 days before the baseline surveys.

[*] Differences in the comparison between PHAs and all other participants combined (CRs plus Others) were statistically significant ($p < .05$).

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Table 6

Indication of Exposure to RAP Peer Intervention at Baseline (B) and Follow-up (F) (percentages within each category unless otherwise indicated)[a]

	PHAs		CRs		Others [b]		Total [c]	
	(B=112)	(F=98)	(B=222)	(F=157)	(B=188)	(F=102)	(B=522)	(F=367)
Received from someone from the RAP project in prior 6 mo.:								
Reading materials	14.0	65.2	4.3	50.9	7.6	35.2	7.9	51.1**
Condoms	3.2	70.4	12.4	58.8	22.0	49.3	22.4	59.4*
Other prevention materials	50.8	78.4	21.9	69.6	30.7	66.0	3.	71.9**
Received prevention info/ demo/materials from any active drug user in the prior 6 mo.:	33.9	59.2	10.9	50.6	18.8	34.7	18.7	51.8*
From someone you know	84.2	96.6	83.3	93.8	72.7	91.7	80.0	93.8
From a stranger	36.1	44.2	26.1	38.5	56.3	35.3	40.7	39.3
Where you usually use drugs	37.5	38.6	45.8	59.0	28.6	48.6	36.4	49.4
Recognized RAP Flip-book	18.9	100	8.2	64.9	9.3	46.5	11.9	69.6**
Number of RAP slogans ever heard at follow-up (mean) [d]		(4908)		(2.096)		(1.823)		(2.790)**
Number of HIV/health issues talked about with other drug users in prior 2 wks (mean) [e]	(2.319)	(5.638)	(1.466)	(2.555)	(1.778)	(2.196)	(1.793)	(3.293)**

[a] Significance indicated is for baseline/follow-up comparisons in the total sample except in the absence of baseline comparisons. For that item, significance is indicated for the comparison between groups.

[b] Includes all CRs of untrained PHAs (n=124 at baseline, n=76 at follow-up) and PHAs who never started the training (n=64 at baseline, n=26 at follow-up).

[c] PHAs who attended 1–4 sessions (n=10) were included in the follow-up total.

[d] Based on a total of six slogans. All slogans were translated into Spanish or replaced with Spanish equivalents. Slogans were not included in the baseline survey to reduce interview influence on this intervention exposure measure.

[e] Based on a total of 14 talking items related to health, transmissible diseases, harm or risk reduction, and treatment.

* $p < .05$;

** $p < .001$

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Table 7

6-Month Follow-up Reported Risk Reduction Behavior Change as a Result of Talking with Someone from RAP

	PHAs (n=98)		CRs (n=157)		Others (n=102)[a]		Total (n=367)[b]		
	n	(%)	n	(%)	n	(%)	n	(%)	p[c]
Drug use risk reduction									
Cut down on drug use	63	(70.8)	80	(54.1)	38	(43.7)	183	(55.0)	**.001**
Started using rubber tips[d]	31	(83.8)	49	(72.1)	22	(51.2)	105	(67.7)	**.005**
Drug injection risk reduction:[e]									
Cut back on syringe sharing	11	(57.9)	13	(37.1)	9	(42.9)	35	(44.9)	.338
More selective needle partners	5	(29.4)	5	(15.2)	2	(10.1)	13	(18.1)	.271
Cleaned with bleach	13	(61.9)	21	(51.2)	15	(53.6)	50	(53.2)	.772
Stopped all syringe sharing	9	(47.4)	7	(20.6)	4	(18.2)	21	(26.9)	.060
Stopped sharing cookers	11	(57.9)	8	(23.5)	4	(18.2)	24	(30.8)	**.011**
Sexual risk reduction:[f]									
Used condoms	37	(57.8)	53	(52.5)	24	(39.3)	117	(50.4)	.102
Reduced # of sex partners	36	(64.3)	41	(42.7)	21	(38.9)	100	(47.2)	**.010**
Health promotion:									
Talked to drug users about HIV prevention	81	(89.0)	54	(38.3)	20	(23.5)	158	(48.5)	**.000**
Talked to drug users about other health issues	78	(88.6)	59	(41.5)	18	(20.9)	157	(48.3)	**.000**

[a] Includes 76 CRs of all untrained PHAs (i.e., those who attended 0–4 training sessions) and 26 PHAs who never started the training; PHAs who attended 1–4 training sessions are excluded from this group.

[b] Ten PHAs who attended only 1–4 sessions were included in the follow-up total.

[c] Chi-square significance calculated across comparison groups for those who reported each preventive or health promotional behavior.

[d] Calculated as percent who smoked crack at follow-up.

[e] Calculated as percent who injected drugs at follow-up.

[f] Calculated as percent who were sexually active at follow-up.

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Table 8

RAP Intervention in Personal Networks[a]

	PHAs (F=95)	CRs (F=142)	Others (F=89) [b]	Total (F=326) [c]
# of PHAs named in network at follow-up (mean)	(.885)	(1.345)	(1.048)	(1.110)*
# of CRs named in network at follow-up (mean)	(.207)	(.147)	(.383)	(.219)*
% of network members gave information to	72.3	32.8	21.2	40.6**
% of network members gave demonstration/materials to	66.9	19.3	10.3	29.9**
% of network members received information from	26.3	36.0	38.7	33.4*
% of network members received demo/materials from	18.9	34.4	29.1	27.7*
% of network members received prevention from in primary drug use site	33.1	39.4	27.8	33.8

[a] Significance is indicated for comparisons between groups.

[b] Includes CRs of all untrained PHAs (i.e., received 0–4 training sessions) and PHAs who attended no training sessions. PHAs who attended 1–4 sessions are excluded.

[c] PHAs who attended only 1–4 sessions were included in the follow-up total.

* $p < .05$;

** $p < .001$