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Using Social Networks to Recruit an HIV Vaccine Preparedness Cohort

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Abstract

Objective—Evaluate a social network approach to develop an adolescent cohort for HIV vaccine preparedness and investigate characteristics that influence recruitment.

Methods—We summarize baseline data from a prospective cohort study that included four sessions over six months. Fifty-nine HIV-infected adolescent and adult patients of a family-based HIV clinic named significant others and indicated willingness to involve them in this study. Sixty-two adolescent and adult significant others not known to be HIV-infected were enrolled. Logistic regression was used to estimate factors associated with willingness.

Results—Participants identified 624 social network members including 276 (44%) adolescents. Network member's awareness of the index's HIV-positivity ($P<0.01$) and older age ($P=0.05$) affected willingness. Respondents were less willing to invite drug-risk alters ($P=0.006$). Adolescents were willing to invite more adolescents than were adults ($P<0.0001$). Adolescents <18 years old reported fewer sexual and drug-using risk behaviors than expected.

Conclusions—HIV-infected patients are willing to recruit their social networks provided concerns about disclosure of HIV status are addressed. Using social networks to identify and recruit adolescent populations is appropriate and feasible for vaccine preparedness activities, future vaccine trials, and other prevention programs, but procedures are needed to selectively identify and retain high-risk youth.

Keywords

Social networks; HIV vaccines; HIV vaccine preparedness

Introduction

As scientists debate the challenges presented by HIV vaccine research, basic vaccine discovery work continues. When a product becomes available, its efficacy will be evaluated among large samples of those most at risk for acquiring HIV. Vaccine preparedness studies and HIV vaccine

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trials conducted in the U.S. have shown that high-risk populations of adult men and women can be successfully recruited, enrolled and retained using targeted recruitment strategies.¹⁻³

While high-risk adolescents may be successfully recruited into HIV prevention research,^{4,5} it is not known whether this is true for HIV vaccine studies in the U.S. Early initiation of sexual behavior, multiple sexual partners, and high rates of sexually transmitted infections (STIs) increase the risk of HIV among youth relative to other age groups.⁶ Indeed, people under age 25 years account for over 50% of all new HIV infections in the U.S.⁷ The development of an HIV vaccine that could be given before a young person becomes sexually active may be essential to reducing the number of new infections among youth, and this vaccine will need to be tested in this age group.

Yet youth most at risk for HIV are often difficult to reach with interventions and research protocols. They tend to come from communities of color, immigrants, and the poor, among whom substantial mistrust of research can be an important barrier.⁸ The very factors that put youth at risk (e.g., sexual behavior and reduced access to health care and education) make them vulnerable to problems resulting from participation in clinical efficacy trials, including stigmatization, discrimination, and problems in interpersonal relationships.^{1,9,10} Young people, for instance, are more likely than older adults to report negative reactions from friends, family members or coworkers, who may assume trial participation signals HIV infection.⁹ Adolescents may be particularly impacted by negative reactions since peer norms and values figure prominently in adolescent concerns and decision-making.¹¹ To avoid these social harms, processes must be established that will address misconceptions among youth and their families about vaccine trials and prevent inadvertent disclosure of trial participation.^{1,4,12-14} Investigators must also develop effective HIV education and prevention strategies to minimize increases in risky sexual and drug using behaviors that may result from a mistaken assumption of being protected by the vaccine.¹⁰

This study was designed to evaluate the potential effectiveness of a social network approach to develop a cohort of adolescents for HIV vaccine preparedness activities and determine participants' willingness to participate in future HIV vaccine trials. The main insight of social network analysis is its focus on the connectivity or link between an individual and significant others.^{15, 16-20} Because adolescents often derive their understanding of appropriate norms and behaviors from their peers, these links represent a primary locus of behavioral influence that may provide a vehicle by which at-risk youth can be identified and recruited.

Recruitment of high-risk individuals for HIV vaccine preparedness studies has often used a venues approach in which researchers identify recruitment locales and invite patrons to participate.^{2,21-24} This method is limited because the prevalence of risk behavior is variable, and chosen settings might lack a sufficient number of eligible recruits. Also, singling out particular groups by high-risk locales (e.g., gay bars) might invite the resistance of business owners and patrons, hindering recruitment in those areas and further stigmatizing the vaccine. Another approach is to embed recruitment within community- or clinic-based services, such as syringe exchange or drug treatment programs.²⁵ However, individuals at highest risk may not seek such services, which in any case may be limited in some communities. Moreover, people approached in this way might actually be less likely to participate than those reached by newspaper advertisements or other study participants.² Researchers also commonly employ mass media or other communication outreach. This technique may reach many potential participants but is not sufficiently selective and may identify people who do not qualify as high-risk.^{2,21,24}

Social network approaches to recruitment have been used in several prevention studies²⁶⁻²⁹ but not, to our knowledge, for clinical trials. In addition to evaluating the effectiveness of the

approach in this context, we investigated socio-demographic and network characteristics that might influence recruitment in such studies, as well as the effects of knowledge about HIV and HIV vaccines. Results have implications for recruitment into any clinical trial testing HIV-preventive biological agents.

Materials and Methods

Study Design and Population

This paper reports baseline results from a prospective cohort study. Participation involved four visits (baseline, two-weeks, and three- and six-months) and two interim telephone calls to update locator information. The design enabled evaluation over time of factors relevant to participation and retention in a hypothetical vaccine trial. From October 2004 through March 2006, HIV-infected adolescent (12-24 years) and adult female (>24 years) patients from the Los Angeles County+University of Southern California Maternal Child and Adolescent Center for Infectious Diseases and Virology (MCA) were recruited from a random-ordered list of current patients by telephone or at their clinic visit. We originally enrolled only adolescents but in December 2005 began enrolling female adult patients because anecdotal evidence from study interviews suggested many of these women would be willing to recruit their HIV-uninfected adolescent children and relatives. Enrolled patients were designated indexes. The study protocol was approved by the local institutional review board. Informed consent was obtained from all participants and, if minors, assent was obtained and consent obtained from their parent or legal guardian.

MCA is a comprehensive multi-disciplinary center of care that has served over 3,000 HIV-infected women, children, adolescents, and their families since 1988. It currently serves 400 families that include 880 patients, of whom 165 (58% HIV-infected) are adolescents and 282 (99% HIV-infected) are adults. Seventy percent are Latino, 25% Black, and 5% from other groups.

Identification and recruitment of network members (alters)—To identify the indexes' social network members (first-degree alters), we asked indexes during the baseline interview to name up to five individuals in each of five groups: (1) family members, (2) closest friends, (3) sexual partners in the past six months (sexual-risk alters), (4) people with whom they used alcohol, marijuana, or drugs in the past six months (drug-risk alters), and, (5) others with whom they spend time. For each alter named, the index provided information about their specific relationship (e.g., neighbor, school or work friend), alter's age, whether the alter knew the index was HIV-infected, and whether the index was willing to invite the alter to participate in this study. Indexes were then asked to bring their alters to the clinic to participate in the study and were given a \$5.00 "finder's fee" for each alter they recruited. Enrolled first-degree alters were asked to provide this same information about their social network members (second-degree alters) although we did not enroll them into this pilot study. Alter enrollment continued through June 2006.

Study visits—The baseline interview included questions about socio-demographic characteristics, health history, alcohol and drug use, sexual behavior, knowledge about HIV, and for alters only, attitudes about people with HIV. After participants read an HIV vaccine fact sheet, we assessed their knowledge about HIV vaccines, willingness to invite family, friends, and risk partners to participate in future HIV vaccine trials, and for alters only, willingness and motivations and barriers to participating in such trials.

Data collection instruments—Questions about socio-demographic characteristics, health history, alcohol and drug use, and sexual behavior were adapted from the HIV Network for

Prevention Trials (HIVNET) Vaccine Preparedness Study,¹ as were assessments of baseline HIV vaccine knowledge (four true/false questions), willingness to participate or ask alters to participate in future HIV vaccine trials (four four-level Likert questions), and motivations and barriers to participating in future HIV vaccine trials (23 four-level Likert items). Assessments of HIV knowledge (19 five-level true/false scale questions) and attitudes about people with HIV (nine three-level Likert items) were modified from the CDC Handbook of Evaluating HIV Education.³⁰ The two-week HIV vaccine re-assessment consisted of 17 true/false items modified from the ATN comprehension test.³¹

Statistical Analyses

Analyses were based on data from the baseline interview. We first compared socio-demographics, risk behaviors, HIV and HIV vaccine knowledge, and network characteristics of indexes and enrolled first-degree alters stratified by adolescent or adult age group. Next, we compared age and network type (risk relationship) between first- and second-degree alters in order to investigate whether the second wave of alters would yield a sufficiently high-risk sample of youth. P-values were estimated from chi-squared tests for categorical variables and independent t-tests for mean comparisons or Wilcoxon rank-sum tests for median comparisons.

The next series of analyses were designed to evaluate characteristics of respondents and each of their alters (as reported by the respondent) that impacted the respondent's willingness to invite the alter to participate in the study. We reshaped the data to be dyadic such that each observation was either an index and first-degree alter pair or enrolled first-degree and second-degree alter pair.^{15,32} The dyadic data are non-independent and clustered on the respondent, and appropriate multi-level models were specified.³³ All variables with $P < 0.10$ in univariate analyses were considered for inclusion, but only variables with $P < 0.10$ remained in the final multivariate model. Odds ratios, 95% confidence intervals, and P-values were estimated from logistic regression with generalized estimating equations.

To investigate whether adolescents or adults were more willing to invite adolescents into this study, we used a logistic regression model to estimate the difference between adolescents and adults. We used independent t-tests to compare adolescent and adult participants with respect to total number of adolescents they named and number they were willing to invite.

We used Spearman's correlation coefficients to investigate whether willingness to invite named family, friends, and risk partners into this vaccine preparedness study was associated with level of willingness to invite them into a future HIV vaccine study.

Results

Cohort Characteristics

Table 1 summarizes key characteristics of the 59 indexes and 62 first-degree alters enrolled in the study (adolescents vs. adults). Indexes were MCA patients for a median of 5.6 years. Adolescent indexes were less likely than adults to be infected hetero- or homosexually; 61% were infected perinatally or by transfusion. Although most of the adolescent and adult indexes were female, the gender distribution among alters was balanced. Age, race and ethnicity, education, and birth in the US were similar for indexes and alters in both age groups. Both adolescent and adult indexes were more likely than alters to have participated in a health research study due to MCA's active clinical research program. Although some adolescent indexes were homosexual, all adolescent alters were heterosexual. Most indexes and alters <18 years old had not had vaginal or anal sex. Among participants who reported ever having sex, >75% in all groups reported <1 sexual partner in the previous three months. Condom use was more consistent among adolescent indexes than adolescent alters. In adults, indexes were more

likely to have had an STI than alters. Approximately 50% of adolescents had used alcohol, tobacco, or marijuana, whereas >70% of adults had. Less than 25% of all groups had used other drugs, and injection drug use was rare. Whereas adolescent indexes and alters had a comparable level of knowledge about HIV, adult indexes had greater knowledge than did adult alters. Adult alters had more positive attitudes about people with HIV than did adolescent alters. On average, indexes and alters named 4-6 social network members and were willing to invite >60% of them into this study.

Social Network Characteristics

Figure 1 depicts the process of identifying social network members. The 59 indexes identified 337 individual first-degree alters. Of these, 306 were named during the study interview, and 31 (10%) were enrolled. Two indexes refused to name any alters and one index named 13 (median=4). Indexes also recruited 31 alters not named during the interview. These 62 enrolled alters named 357 second-degree alters (range =0-15, median=5), and of these 339 individuals, 287 had not been previously named by either indexes or first-degree alters. In sum, the 59 indexes yielded 624 non-duplicated social network members who could potentially be enrolled in an HIV vaccine preparedness effort.

The median network size was 8 (range=1-52) and respondents were willing to invite a median of 5 (range=0-31) network members. Figure 2 shows examples of the size, nature and variety of the social networks observed in this study, as well as whether the network member was willing to participate in vaccine preparedness activities. Indexes and alters sometimes identified the same alters (a). Some participants reported willingness to invite all the alters they named (b, left-side), but others were willing to invite only a select few (b, right-side). The networks have varying degrees of overlap among their members. Some indexes recruited alters who also named the index and the same alters (c); others named alters who did not name each other and these alters exhibited varied patterns of willingness (d). In (d), the index named many alters who also named many alters, generating a comparatively large pool of potential participants.

The comparison of the characteristics of first- and second- degree alters (Table 2) showed that more than 50% of both groups were children or adolescents. Second-degree alters were marginally less likely to be family members and more likely to be drug-risk partners.

Willingness to Invite Alters to Participate in Vaccine Preparedness Activities

Indexes and alters reported willingness to invite 421 (66%) of 635 social network members they named (data are missing for 29 alters). Univariate analyses (Table 3) showed that indexes and alters were similarly willing to invite alters. Adolescents were less willing than adults. HIV knowledge was positively associated with willingness, but knowledge about HIV vaccines and attitudes about people with HIV were not. There was a borderline positive association with history of an STI. Respondents were less willing to invite children or adolescents than adults, and sexual- or drug-risk partners than family members. Indexes were more willing to invite alters who knew their HIV-positive status than alters who did not know their status. They were also more willing than were HIV-uninfected respondents to invite their alters. In multivariate analysis, the relationships between willingness and network member's older age, awareness of an index's HIV-positivity and drug risk remained significant. Despite a strong association in the univariate analysis, HIV knowledge was only marginally associated with willingness after adjusting for other factors.

Additional analyses showed that although adults were more willing to invite the adolescents they named (90% vs. 60%, $P=0.002$), on average, adolescents named more adolescents (3.3

vs. 0.8, $P < 0.0001$). Therefore, the average number of adolescents that respondents were willing to invite was significantly higher for adolescents than adults (1.9 vs. 0.7; $P < 0.0001$).

We found statistically significant positive correlations between the number of named family members ($r = 0.29$, $P = 0.0016$), friends ($r = 0.22$, $P = 0.02$) and sex- and drug-risk alters ($r = 0.43$, $P = 0.0001$) whom respondents were willing to engage in vaccine preparedness and their level of willingness to invite each group to participate in a future HIV vaccine study.

Discussion

To determine whether a social network approach might identify a high-risk cohort of adolescents for vaccine preparedness studies and future vaccine trials, we asked HIV-infected patients of a family-based HIV clinic to identify and recruit family members, friends, and sexual- and drug-risk partners to participate in an HIV vaccine preparedness study. Adolescents and adults were generally willing to name network members and provide information about them. Although participants were most likely to name family and friends, they also named sexual- and drug-risk partners and were willing to invite at least some in each group to participate in this study.

Adult participants were more willing than adolescents to invite network members. No differences were found by gender, risk behavior, or education. We also found that adults were more willing than adolescents to invite youth. However, adolescents named a greater number of adolescents and therefore the potential yield for future studies is greater among adolescents than adults. This advantage might be mitigated by the greater difficulty of obtaining parental consent when adolescents identify other adolescents and the parent is not already participating in the study.

One concern about recruiting minors from adolescent referral is the risk of social harm resulting from network members' negative reactions to youth participation. This is a particular issue in the context of study procedures that actively encourage disclosure of study participation (i.e., for the purpose of inviting network members to participate). Yet by identifying important others for study participation, social network methodology can also facilitate educational efforts that address the public's limited knowledge of HIV vaccines. This in turn, may mitigate negative attitudes toward trial participation.

Indexes were significantly more willing to invite network members who knew the index was HIV-infected. This suggests that concerns about confidentiality and inadvertent disclosure affected patients' willingness to engage associates. Similarly, willingness to engage associates could be affected by the requirement for HIV testing of alters. If testing would take place in the clinic where the index is receiving care, inadvertent disclosure of the index's HIV+ status is a concern. As second- and third-degree alters are recruited in future studies using this methodology and the HIV-infected index becomes further removed from the recruitment process, disclosure concerns will become less relevant. However, that HIV-infected indexes were more willing to recruit alters to whom they had disclosed than were first-degree alters to recruit second-degree alters indicates greater motivation due to their status. This emphasizes the importance of understanding the factors that influence willingness in a clinic-based setting. Future HIV vaccine trials will likely be conducted in this setting because medical providers and nursing staff will need to administer the vaccine and monitor vaccine side effects. Furthermore, youth-friendly clinic-based health care can enable the identification and recruitment of youth and facilitate their participation in clinical trials.³⁴

Participant understanding of HIV infection is essential for understanding how a vaccine might work and is critical for informed consent. It is also an ethical necessity, given the possibility that risk behaviors might increase if youth mistakenly believe they are protected from HIV

acquisition by the candidate vaccine.¹⁰ Our results, though not statistically significant, suggest that HIV knowledge might also increase willingness to invite network members to participate in preparedness activities.

That we found no association between vaccine knowledge and willingness is consistent with some previous research on willingness to participate in vaccine trials.^{35,36} In contrast, in an earlier study, high-risk adults reported that receiving education about HIV vaccines and trial participation would be critical to their willingness.³⁷ Possibly vaccine preparedness activities are removed enough from actual trial participation to render concerns about the vaccine less salient. Alternatively, this outcome may reflect a lack of statistical power in our analysis and the fact that our questions were asked immediately after participants read the HIV vaccine fact sheet. We felt that the fact sheet was important because we expected that participants would know virtually nothing about HIV vaccines or vaccine trials at baseline.^{1,38} However, we may have measured short-term retention rather than actual vaccine knowledge in this baseline analysis. Our prospective design in the larger study will enable evaluation of long-term retention of this information.

Of interest in this research was whether willingness to invite alters to vaccine preparedness activities reflected willingness to engage them in hypothetical future HIV vaccine trials. The positive correlations we found suggest that since respondents overall were willing to engage most of the alters they named, social network methodology may lead to a high degree of engagement of alters into future HIV vaccine trials.

Given our interest in enrolling high-risk youth, of concern was the fact that participants were willing to invite the few named alters with whom they had had sex and used drugs but not necessarily those with whom they had had either sex or drug relationships. This is consistent with research on the role of multiplex versus uniplex relations in social networks. Multiplex relations, in which individuals are linked on more than one relation³⁹ (such as co-workers who are also friends), may have more interpersonal influence.^{40,41} The multiple links provide more opportunities for information exchange that can lead to a greater willingness to invite.

One limitation of this study was the lack of sufficient resources to investigate non-enrollment of alters whom indexes reported willingness to recruit (i.e., whether the indexes or alters were actually not willing and the reasons for non-participation, including logistical issues, concerns about an HIV study, and fluctuating social networks). This information would have informed future efforts to develop such cohorts.

We have emphasized that network methods of referral may provide access to high-risk youth who may be critical recipients of a future vaccine, and that an expected advantage of social network methodology is access to a cohort of youth well beyond that available by traditional approaches. To the extent that social network members share beliefs, values, and socioeconomic circumstances with HIV-infected important others, they are likely to be at increased risk themselves. The alters recruited here, however, reported fewer sexual and drug-using risk behaviors than expected. It is possible our study design did not allow for the adequate identification of risk because we relied on self-reported measures, and alters may have under-reported their risk. Yet this is more likely for clinic patients (indexes) who had established relationships with clinic providers, than for alters, who did not have such relationships. In addition, we did not exclusively enroll high-risk indexes which would have increased the likelihood of a high-risk sample of alters. Future studies utilizing social network methods should obtain biological measures, such as HIV and other STI tests, in addition to self-reported measures of risk, and enroll only those at high risk. Materials and procedures should encourage the recruitment of risk partners through interview scripts that reinforce commitment to confidentiality and the importance of involving risky others.

A related issue is generalizability—the extent to which our findings can inform the development of an adolescent cohort of social network members that originates from a clinic not similar to ours, for example one that is not family-based or does not target HIV-infected youth. Whether our findings can be replicated in other clinics, both similar and different from ours, is a question for future research.

Results from this study have important implications for recruitment of adolescents into clinical trials testing HIV-preventive biological agents. The social networks of HIV-infected patients receiving care can be used to effectively recruit adolescent populations for trials and interventions. Even if effective preventive HIV vaccine trials do not include adolescents in the near future, it is essential to study techniques and develop procedures that will selectively identify and retain “hard to reach” at-risk youth for clinical trials and protect their rights as research subjects.

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Figure 1.
Identification and enrollment of social network members (alters) of HIV-infected patients (indexes).

Figure 2.

Examples of social network linkages among indexes and alters. Squares are index patients; triangles, enrolled alters; and circles, named but not enrolled alters. Links are coded by willingness to invite alter to participate in vaccine preparedness activities: solid arrows represent willing, dashed arrows, not willing; dash-dotted arrows, absence of a response; and dash-dot-dot, enrolled but not named 1st degree alters.

Enrollment Characteristics of HIV-infected Patients (Indexes) and Their Enrolled Social Network Members (First-degree Alters) Stratified By Age Group.

Table 1

	Adolescent (12-24 years)			Adult (25+ years)		
	Index (n=41)	Alters (n=39)	P*	Index (n=18)	Alters (n=23)	P*
Years at MCA, median (range)	5.4 (0.2-17.0)	N/A		5.7 (1.9-14.2)	N/A	
Route of HIV infection						
Heterosexual	13 (32%)	N/A		15 (83%)	N/A	
Homosexual	3 (7%)			0		
Perinatal	16 (39%)			0		
Transfusion/hemophilia	9 (22%)			1 (6%)		
Injection drug use	0			1 (6%)		
Undetermined/other	0			1 (5%)		
Gender						
Male	12 (29%)	21 (54%)	0.06	0	9 (39%)	0.003
Female	28 (68%)	18 (46%)		18 (100%)	14 (61%)	
Transgender	1 (3%)	0		0	0	
Age in years, mean (SD)	18.9 (3.5)	18.1 (3.4)	0.32	35.6 (7.9)	39.9 (11.2)	0.17
Race/ethnicity						
Black	15 (37%)	18 (46%)	0.69	12 (67%)	13 (56%)	0.79
Hispanic	21 (51%)	17 (44%)		5 (28%)	8 (35%)	
Other	5 (12%)	4 (10%)		1 (5%)	2 (9%)	
Education						
Less than high school graduate	24 (59%)	25 (64%)	0.72	10 (55%)	9 (39%)	0.28
High school graduate	9 (22%)	9 (23%)		3 (17%)	2 (9%)	
Some college or higher	8 (19%)	5 (13%)		5 (28%)	12 (52%)	
Born in USA						
Yes	33 (80%)	26 (67%)	0.16	12 (67%)	18 (78%)	0.41
No	8 (20%)	13 (33%)		6 (33%)	5 (22%)	
Ever participated in a health research study before						
Yes	33 (81%)	6 (15%)	<0.001	15 (83%)	3 (13%)	<0.001
No	5 (12%)	32 (82%)		2 (11%)	20 (87%)	
Don't know	0	1 (3%)		1 (6%)	0	
Unknown	3 (7%)	0		0	0	
Heterosexual/straight						
Yes	36 (88%)	39 (100%)	0.02	18 (100%)	22 (96%)	0.37
No	5 (12%)	0		0	1 (4%)	
Ever had vaginal/anal sex (<18 yrs only)						
Yes	5 (36%)	2 (12%)	0.11			
No	9 (64%)	15 (88%)				
No. of sex partners in past 3 months**						
None	9 (33%)	3 (14%)	0.27	3 (17%)	3 (14%)	0.45
1 partner	14 (52%)	14 (63%)		14 (78%)	14 (67%)	
2+ partners	4 (15%)	5 (23%)		1 (5%)	4 (19%)	
How often used condom in past 3 months***						
Always	11 (61%)	6 (32%)	0.06	5 (34%)	7 (39%)	0.44
Sometimes	7 (39%)	9 (47%)		8 (53%)	6 (33%)	
Never	0	4 (21%)		2 (13%)	5 (28%)	
Ever had a sexually transmitted infection (STI)						
Yes	9 (22%)	4 (10%)	0.17	8 (44%)	4 (18%)	0.07
No	32 (78%)	34 (87%)		10 (56%)	18 (78%)	
Don't know or missing	0	1 (3%)		0	1 (4%)	
Ever used alcohol/cigarettes/marijuana						
Yes	19 (46%)	14 (36%)	0.95	10 (56%)	12 (52%)	0.96

	Adolescent (12-24 years)			Adult (25+ years)		
	Index (n=41)	Alters (n=39)	P*	Index (n=18)	Alters (n=23)	P*
No	21 (51%)	15 (38%)		4 (22%)	5 (22%)	
Unknown	1 (3%)	10 (26%)		4 (22%)	6 (26%)	
Ever used other drugs not prescribed by a doctor						
Yes	7 (17%)	9 (23%)	0.50	4 (22%)	4 (17%)	0.72
No	33 (81%)	29 (74%)		12 (67%)	16 (70%)	
Unknown	1 (2%)	1 (3%)		2 (11%)	3 (13%)	
Ever injected drugs						
Yes	0	0		1 (6%)	1 (4%)	0.86
No	41 (100%)	38 (97%)		17 (94%)	22 (96%)	
Unknown	0	1 (3%)		0	0	
Baseline HIV knowledge ^a						
Mean (SD)	13.2 (3.4)	12.6 (3.2)	0.44	15.3 (2.0)	14.0 (2.2)	0.07
Median (range)	14 (6-18)	13 (6-17)	0.34	16 (11-18)	14 (10-18)	0.04
Baseline HIV vaccine knowledge ^b						
Mean (SD)	3.4 (0.8)	3.4 (0.9)	>0.99	3.5 (0.6)	3.7 (0.8)	0.47
Median (range)	4 (2-4)	4 (1-4)	0.84	4 (2-4)	4 (1-4)	0.15
Attitudes about people with HIV (# questions with response is not OK)						
None	N/A	20 (51%)		N/A	19 (83%)	
1 question		7 (18%)			3 (13%)	
2-9 questions		11 (28%)			1 (4%)	
Missing		1 (3%)			0	
Network size						
Mean (SD)	5.5 (3.2)	5.7 (3.1)	0.77	4.6 (2.5)	5.9 (4.3)	0.26
Median (range)	4 (0-13)	5 (0-12)	0.66	5 (0-8)	6 (0-15)	0.36
% of network willing to invite [†]						
Mean (SD)	64 (32)	60 (34)	0.66	80 (27)	66 (35)	0.19
Median (range)	74 (0-100)	59 (0-100)	0.77	100 (0-100)	79 (0-100)	0.16

* Unknowns are not included in calculation of chi-square p-value.

** Includes only individuals who reported ever having vaginal/anal sex

*** Includes only individuals who reported having ≥1 sex partner(s) in the past 3 months.

[†] Includes only individuals with ≥1 or more network members.

^a Baseline HIV knowledge = total questions correct/total questions answered × 19; item assessed for 59 indexes and 61 alters

^b Baseline HIV vaccine knowledge = total questions correct/total questions answered × 4; item assessed for 54 indexes and 60 alters

Table 2

Characteristics of Social Network Members Named By Index and Alter Participants

	First-degree alters (n=307)	Second-degree alters (n=357)	<i>P</i> [*]
Age in years, mean (SD)	28.1 (13.9)	26.3 (14.2)	0.11
Age categories (years)			0.11
0-11	13 (4%)	32 (9%)	
12-17	55 (18%)	68 (19%)	
18-24	79 (26%)	91 (26%)	
25+	145 (47%)	155 (43%)	
Unknown	15 (5%)	11 (3%)	
Network relationship type			0.06
Family	166 (54%)	161 (45%)	
Friendship	73 (24%)	89 (25%)	
Sexual risk	32 (10%)	32 (9%)	
Drug risk	10 (3%)	21 (6%)	
Drug risk and family or friend	13 (4%)	22 (6%)	
Sexual- and drug-risk	5 (2%)	11 (3%)	
Other	8 (3%)	21 (6%)	

* Unknowns are not included in calculation of chi-square p-value.

Table 3

Factors Associated With Willingness to Invite Network Members to Participate in This Vaccine Preparedness Study, Univariate and Multivariate Analyses

	Univariate analysis		Multivariate analysis (N=614)	
	Odds Ratio (95% CI)	P	Odds Ratio (95% CI)	P
Respondent's Characteristics				
Respondent type				
Alter	1.00			
Index	1.18 (0.65-2.14)	0.59		
Age, per year increase	1.03 (0.99-1.07)	0.18		
Age categories (years)				
<18	0.34 (0.16-0.73)	0.006		
18-24	0.45 (0.22-0.92)	0.03		
25+	1.00	p-trend = 0.004		
Gender				
Male	1.00			
Female	1.25 (0.67-2.35)	0.48		
Transgender	N/A	N/A		
Race/ethnicity				
Black	1.00			
Hispanic	0.81 (0.43-1.54)	0.53		
Other	0.65 (0.24-1.75)	0.39		
Education				
Less than high school graduate	1.00			
High school graduate	0.92 (0.43-1.95)	0.82		
Some college or higher	1.00 (0.47-2.14)	1.00		
		p-trend = 0.98		
Born in USA				
Yes	1.00			
No	1.29 (0.71-2.34)	0.41		
Ever participated in a health research study before				
Yes	1.00			
No	1.04 (0.57-1.93)	0.89		
Don't know	0.62(0.08-4.90)	0.65		
Heterosexual/straight				
Yes	1.00			
No	1.28 (0.31-5.31)	0.73		
Ever had vaginal/anal sex (<18 yrs only)				
Yes	1.00			
No	0.88 (0.27-2.80)	0.82		
No. of sex partners in past 3 months				
None	1.00			
1 partner	1.06 (0.57-1.98)	0.84		
2+ partners	0.92 (0.35-2.44)	0.87		
How often used condom in past 3 months				
Always	1.00			
Sometimes	1.05 (0.44-2.52)	0.91		
Never	0.73 (0.24-2.23)	0.58		
		p-trend = 0.67		
Ever had an STI				
No	1.00			
Yes	1.95 (0.94-4.03)	0.07		
Ever used alcohol/cigarettes/marijuana				
No	1.00			

	Univariate analysis		Multivariate analysis (N=614)	
	Odds Ratio (95% CI)	P	Odds Ratio (95% CI)	P
Yes				
Ever used any other drugs not prescribed by a doctor	0.78 (0.41-1.48)	0.44		
No	1.00			
Yes				
Baseline HIV knowledge ^a	1.18 (0.61-2.31)	0.63		
Baseline HIV vaccine knowledge ^b	1.13 (1.04-1.24)	0.007	1.10 (1.00-1.21)	0.056
Attitudes about people with HIV ^c	0.89 (0.64-1.25)	0.51		
Attitudes about people with HIV ^c	1.05 (0.49-2.25)	0.90		
Network Member Characteristics				
Age, per year increase	1.04 (1.02-1.07)	0.001	1.03 (1.00-1.05)	0.048
Age categories (yrs)				
<12	0.08 (0.04-0.18)	<0.001		
12-17	0.42 (0.22-0.78)	0.006		
18-24	0.53 (0.32-0.88)	0.01		
25+	1.00			
		p-trend <0.001		
Network relationship type				
Family	1.00		1.00	
Friend	0.86 (0.50-1.47)	0.58	1.43 (0.79-2.57)	0.24
Sexual risk	0.58 (0.32-1.04)	0.07	0.56 (0.29-1.08)	0.09
Drug risk	0.22 (0.09-0.56)	0.001	0.22 (0.08-0.65)	0.006
Drug risk and family or friend	0.66 (0.24-1.82)	0.42	0.74 (0.27-2.08)	0.57
Sexual- and drug-risk	1.31 (0.39-4.36)	0.66	1.09 (0.32-3.71)	0.89
Other	2.91 (0.53-15.91)	0.22	2.70 (0.52-13.91)	0.24
Network size, per person increase	0.95 (0.86-1.05)	0.35		
Alter knew index's HIV+ status				
Yes	1.00		1.00	
No	0.07 (0.04-0.14)	<0.001	0.11 (0.05-0.23)	<0.001
Not applicable (Alter of HIV-enrolled alter)	0.29 (0.15-0.58)	<0.001	0.36 (0.18-0.76)	0.007

* Mean (SD) for willing to invite

[†] Variables pertaining to alter respondents only.

^{††} P-values <0.05 are bolded

^a Baseline HIV knowledge = Total questions correct/total questions answered × 19

^b Baseline HIV vaccine knowledge = Total questions correct/total questions answered × 4

^c Attitudes about people with HIV = Total score/9. Value of responses are Really OK = 3, OK = 2, and Not OK = 1.