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The role of social networks and geography on risky injection behaviors of young persons who inject drugs

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Abstract

Background—Little is known about young persons who inject drugs (PWID), who are increasingly from suburban communities and predominantly non-Hispanic white.

Methods—We conducted a cross-sectional personal network (egocentric) and geographic study of young PWID and their drug-using, sexual, and support network members in 2012-13 in metropolitan Chicago, Illinois, U.S.

Results—We enrolled 164 young (median age=26), mostly male (65%), non-Hispanic white PWID (71%), with a self-reported HCV prevalence of 13%. Many (59%) reported multiple residences (i.e., were transient) in the past year, 45% of whom reported living in both urban and suburban places (i.e., were cross-over transients). In multivariable analyses that adjusted for participant and network member characteristics, (1) large injection networks were more common among homeless participants; and (2) syringe sharing was (a) highest among cross-over transients compared to suburban (OR = 4.19 95% CI 1.69 – 10.35) and urban only residents (OR = 2.91 95% CI 1.06 – 8.03), (b) higher among HCV-unknown compared HCV-negative participants (OR =

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Contributors: Basmattee Boodram (principal investigator) and Carl Latkin (co-investigator) contributed at every step of the study including design, protocol development, and implementation of the study. Mary-Ellen Mackesy-Amiti undertook the statistical analysis of the data and contributed significantly to the writing of the manuscript. All authors contributed to and approved the final manuscript.

4.62 95% CI 1.69-10.35), (c) more likely with network members who were cross-over transients compared to urban (OR = 4.94, 95% CI 2.17 – 11.23) and (d) less likely with network members with HCV-unknown compared to HCV-negative status (OR = 0.4 95% CI 0.19 – 0.84).

Conclusions—We identified homelessness as a significant risk factor for large networks and cross-over transience as a significant risk factor for syringe sharing. Further research is needed to understand the role of geographic factors promoting higher risk among these crossover transient PWID.

Keywords

persons who inject drugs; young; transient; homeless; syringe sharing; injection networks

1. Introduction

Injection drug use (IDU) is a well-established risk factor for bloodborne infections and the primary mode of hepatitis C (HCV) transmission in developed countries (Alter, 2007). Studies frequently report associations between HCV infection and injection duration, injection frequency, cocaine injection, and sharing of syringes and other injection paraphernalia among persons who inject drugs (PWID; Boodram et al., 2010; Falster et al., 2009; Garfein et al., 1996; Hagan et al., 2001; Pouget et al., 2012; Thorpe et al., 2000). Recent trends show that although both HIV (Broz et al., 2014; Centers for Disease Control and Prevention, 2009) and HCV (Amon et al., 2008) prevalence have steadily declined among older PWID, high-incidence of HCV infection (Page et al., 2009; Zibbell et al., 2015) and HCV outbreaks among younger PWID (Centers for Disease Control and Prevention, 2011; Leuchner et al., 2008) are occurring. In addition, IDU has been steadily increasing among youths (Chatterjee et al., 2011; Tempalski et al., 2013), and high levels of risky injection and sex behaviors continue to be reported in this group (Broz et al., 2014; Hahn et al., 2010; Rondinelli et al., 2009).

Concurrent with these trends has been a demographic and geographic shift in the profile of young PWID across the United States (U.S.), who are increasingly from suburban communities and predominantly non-Hispanic (NH) white (Armstrong, 2007; Broz and Ouellet, 2008; Broz et al., 2014; Neaigus et al., 2006; Prussing et al., 2014). In the few recent U.S. studies that specifically focused on young PWID (≤ 30 years old), NH-whites were the dominant racial/ethnic group, and African Americans constituted only small fractions of the samples (Garfein et al., 2007; Hahn et al., 2010; Ochoa et al., 2001; Pugatch, 2006). Nonetheless, there is wide geographic variation in HCV occurrence among young PWID (Centers for Disease Control and Prevention, 2011; Garfein et al., 2007, 1996; Hagan et al., 2007; Hahn et al., 2010; Leuchner et al., 2008; Page et al., 2009; Zibbell et al., 2015). Even after adjusting for the racial/ethnic shift, young (aged 15-30) non-Hispanic white PWID from Baltimore were 3.5 times more likely than Chicago PWID to be HCV-infected, after adjusting for individual-level injection risk (e.g. syringe and paraphernalia sharing) and structural factors such as syringe exchange program (SEP) availability (Boodram et al., 2010). The findings from this study may be partially explained by social network and social geographic characteristics that affect the likelihood of having an infected partner among young PWID.

Social network factors have been found to be associated with transmissions of HIV and sexually-transmitted infections (STIs), and network size, composition (i.e., characteristics) and density (i.e., level of connectedness among network) have been found to be associated with HIV risk behaviors, such as sharing injection equipment (reviewed in De et al., 2007). Large, dense networks offer more opportunities for sharing syringes and paraphernalia as previously reported (Latkin et al., 1995, 1996; Needle et al., 1998; Suh et al., 1997) and are more likely to have HCV-positive members, especially among homeless populations (Latkin et al., 1998b; Stein and Nyamathi, 2004).

Geographic factors can directly and indirectly affect HIV/HCV risk by altering a person's injection network. For example, residential transience (German et al., 2007; Roy et al., 2011) may impact HIV/HCV risk through increased network turnover (Costenbader et al., 2006; Hoffmann et al., 1997) by disrupting social ties, and increased frequency of injecting in semi-public places (e.g. shooting galleries) that present more opportunities for engagement in high-risk practices and with high-risk partners due to lack of safe injection spaces (German et al., 2007). In addition, structural geographic factors such as the distance and settings (e.g. urban, suburban) of SEPs and places to purchase drugs relative to a person's residence may promote transience across potentially high and low HIV/HCV prevalent areas. Our study reports novel data on young PWID and their drug using networks from both urban and suburban areas of a large metropolitan city. Specifically, we examine whether individual, injection network, and geographic factors are associated with increasing network size and syringe sharing among young PWID.

2. Materials and Methods

2.1. Study design and population

We conducted a cross-sectional personal network (egocentric) and geographic study of 164 young PWID (egos) and their drug-using, sexual, and support network members (alters) from September, 2012 to June, 2013. Here, we report primarily on the drug-using network. Recruitment flyers were posted at four standalone field sites in Chicago, Illinois, U.S. located near major heroin and cocaine markets that attract both urban and suburban drug users as well at venues that provide services to PWID in these areas. These community areas have rates above the city's average for HIV/AIDS, STIs, viral hepatitis, and arrests for drug-related offenses, as well as lower median household incomes. The majority of participants were registered members of a large Chicago SEP that operated at the field sites. All individuals responding to posted flyers were directed to on-site research staff (not SEP service providers) for eligibility screening. To be eligible, individuals had to be 18 to 30 years old and current injectors, i.e., injected drugs at least once in the past 30 days. Current injection was verified by the presence of injection marks and knowledge of injection procedures. All 164 participants received $30 total for completion of the individual, network, and geographic surveys. The surveys were conducted by two trained study interviewers. All participants provided written informed consent, and all study procedures were approved by the Institutional Review Board of the University of Illinois at Chicago prior to implementation.

2.2. Data collection

We interviewed participants to collect all data. Participants self-reported demographic information, HIV and HCV status, drug and sexual behaviors for the past 6 months, and geographic data on the location and characteristics of places where they resided, purchased drugs, injected drugs, and met sex partners in the past year. Due to a glitch in the survey instrument, participant place of birth was provided for only 63% (n=104/164) of the sample; however, there were no significant differences by demographic, behavioral or geographic characteristics from the entire sample. The drug-using network for each participant was generated as follows. Participants completed an interviewer-administered network generator interview to nominate all drug-using persons (not necessarily PWID) they injected drugs with in the past 6 months. Of the total persons reported, participants were asked to designate up to 10 names of people with whom they injected most often; this group was considered the 'core' drug network. People the participant injected with only once and those they injected with least often were considered non-core. Participants provided all data on network members. Basic demographic information (i.e., age, race/ethnicity, gender, place of residence) was collected on all network members, while more extensive demographic, drug and sexual behaviors and practices, HIV and HCV status, and geographic data on the location and characteristics of places where individuals reside, purchase drugs, inject drugs, and meet sex partners in the past year were collected on core network members only. In addition, for each core network member, participants were asked to rate how much they trusted the person, how often they talked, how far away they lived, where they met, and how often they shared syringes or other injection equipment (cookers, cotton, rinse water) with this person (none, less than monthly, monthly, weekly, daily).

2.3. Measures

Syringe sharing was examined as a dichotomous variable (none vs. ≥1 or more times) based on the question 'in the last six months, how often did you use a needle/syringe that you know for sure had been used before you by someone else?' Homeless individuals were those who answered yes to 'have you been homeless in the past six months, including living a shelter or street'. Place of residence(s) was based on the question 'list all of the places (cross-street, town, state) you have lived in the past year, along with the date range for each residence'. Transients were individuals who reported living in more than one residence in the past year. Cross-over transients were individuals who listed more than one residence in the past year that were located in both urban (i.e., within the city limits of Chicago, Illinois) and suburban (i.e., outside the city limits, within Illinois) areas. Place of birth was defined as using the question 'list the town and state of where you were born'?

2.4. Statistical analyses

We performed all univariate, bivariate, and multivariable analyses using Stata 13 (StataCorp, 2013). Means and medians were calculated for continuous variables and compared using Student's t-test, whereas categorical variables were examined using Pearson's chi-square test. Associations were considered statistically significant at $p < .05$ (two-tailed). In multivariable analyses, independent ego and network predictors of two outcomes were examined: engaging in high risk behavior (sharing syringes) and core

network size. We conducted a multivariable negative binomial regression analysis of core injection network size to examine associations with ego HCV status, demographic characteristics (gender, race/ethnicity, age, homelessness, place of residence), and injection behavior (daily injection, years injecting). We analyzed associations between syringe sharing with core network members and ego characteristics using generalized estimating equations (GEE) logistic regression to adjust for clustering of network members on the ego. We selected variables to be modeled based on prior substantive knowledge from the literature and/or hypothesized associations. The final models included age, race/ethnicity and other demographic, network and geographic variables that were statistically significant ($p < 0.05$).

3. Results

3.1. Participant (ego) characteristics

Table 1 reports the socio-demographic characteristics for the 164 young PWID (median age=26), who were mostly male (65%), born in suburban Chicago areas (58%), and non-Hispanic white (71%) participants. Many participants (59%) were transient; similar to all participants, transients were mostly NH-white, but were more likely than non-transients to share syringes ($p < .001$), to engage in other risk practices such as sharing other equipment ($p < .01$) and backloading (i.e., syringe-mediated drug sharing) ($p < .01$), and to self-report being HCV-infected ($p < .05$). Transients were significantly ($p < .0001$) more likely live in both urban and suburban areas (i.e., cross-over transients) (45%) in the past year compared to exclusively living in either urban Chicago (29%) or suburban areas (26%). Closer examination of cross-over transients reveals them to also be mostly homeless (81%) and to have higher levels of transiency (3.8 places lived in the past year) compared to transients who live exclusively in urban (3.1) and suburban (2.6) areas ($p < .01$). Given the compounded risk of homelessness, unstable residence, and a potential bridge between areas with high (Chicago) and low (suburban) prevalence of HIV and HCV, we further examined this cross-over transient group (n=44, 27%) compared to all participants with residence(s) only in urban (n=59, 36%) or suburban (n=61, 37%) areas. In bivariate analyses cross-over transients were significantly more likely than those who did not move between areas to report place of birth as the suburbs (73%, $p<.0001$), to be younger ($p < .05$), to be homeless ($p < .001$), to inject with a syringe used before by someone else ($p < .05$), and slightly more likely to engage in other risk practices such as sharing other equipment, backloading, selling drugs and exchanging sex for money ($p < .1$).

Table 2 reports on drug use and risk behaviors of participants. Almost all participants reported injecting heroin by itself in the past 6 months (99%), and a substantial group (33%) reported also injecting multiple drugs in the past 6 months. Length of injection career was short (median = 6 years, range = ≤1-14). Most participants reported injecting with others in the past 6 months (79%) and having had a sex partner who also injects drugs (54%), and few always injected with a new syringe (18%). Most participants reported having been tested for HCV (71%); self-reported HCV prevalence was 13% and HIV was <1%.

3.2. Drug network (alter) characteristics

Of the 164 participants, 148 (90%) reported a total of 565 core drug-using network members (median network size = 3), 13 reported no drug-using network, and three reported only one-time (non-core) partners. Participants with (n=148) and without (n=16) a core drug-using network were similar ($p > .05$) on age, gender, race/ethnicity, place of residence, and self-reported HCV. Non-core networks were similar to core networks on age and race/ethnicity, were slightly more likely to be male ($p=.07$), and were significantly more likely to live in Chicago ($p<.001$). For the 565 core network members, participants reported that in the past six months 468 (83%) had injected drugs and 97 (17%) used only non-injection drugs. Five participants reported only non-injecting core network members. Network analyses were completed with and without the 97 non-injecting network members, with no significant differences found in univariate and multivariable analyses. Therefore, we report on the total 565 core drug-using network members.

Compared to the participants, the overall core drug-using network was slightly older (mean=29.7 vs. 26.0 years old) and similarly likely to be non-Hispanic white. A minority of participants reported at least one core drug-using network member who was also a sexual partner (33%) or social support partner (22%). In total, 11% and 7% of the core drug-using network members were also sexual partners or social support partners, respectively. In addition, 37% of participants shared a residence with at least one network member, with 13% of all core drug-using network members being co-residents. Table 3 reports the characteristics of the drug use network by participant (ego) characteristics. Drug use network size was significantly larger for homeless participants ($p < .01$), and HCV positive individuals tended to have slightly larger networks than others. Networks tended to be more homophilous among non-Hispanic white participants (80%) compared to other groups. Participants who lived in only urban (70% homophilous) and suburban (78%) areas in the past year similarly tended to have more homophilous networks compared to cross-over transients (11%). Crossover transient participants also tended to have more urban than suburban network members (data not shown); on average, 61% of their network members currently lived in urban areas. Syringe sharing with network members did not vary significantly according to participant age, gender or race/ethnicity; however, it did vary according to residence, with urban only residents sharing least (10%) and crossover transients sharing the most (23%) ($p < .05$). In addition, participants who reported testing HCV negative shared syringes with a smaller proportion of their network compared to those who reported testing positive or were untested ($p < .01$).

3.3. Network size

After adjusting for age, race/ethnicity, gender, residence status, and HCV status, only homelessness was significantly associated with core network size ($p < .05$) in a negative binomial regression model (data not shown). Being homeless in the past year increased the expected size of the core network by 30% (IRR = 1.30, 95% CI 1.01 - 1.68). The marginal means of core network size were 3.3 for participants who were not homeless and 4.3 for those who were homeless.

3.4. Syringe sharing

Table 4 shows GEE models predicting syringe sharing with network members. All respondent factors that were important predictors (e.g. gender, residence, HCV status) of syringe sharing in the first model that adjusted only for respondent characteristics were also significant in the second model that additionally adjusted for network member characteristics as well as including an interaction between participant gender and network gender. In the network adjusted model, for male participants, sharing did not vary by network member gender; for female participants, sharing was significantly more likely (OR = 3.29, 95% CI 1.36 – 7.94) with male network members, even while adjusting for sex partner status. In this model, cross-over transients were significantly more likely to share syringes when compared to suburban only (OR = 4.19 95% CI 1.69 – 10.35) and urban only (OR = 2.91 95% CI 1.06 – 8.03) residents. Additionally, unknown HCV status was associated with a four-fold increase in the likelihood of syringe sharing compared to self-reported HCV negative status ($p < .01$). Network member characteristics that increased risk for syringe sharing among participants were living in the same household ($p < .001$), and to a lesser extent ($p < .01$), having a drug use network member who is also a sexual partner (multiplexity). Participants were much more likely to share with a cross-over transient compared to an urban network member (OR = 4.94, 95% CI 2.17 – 11.23) and less likely to share syringes with a network member whose HCV status was unknown to them, compared to those who they perceived to be HCV-negative (OR = 0.40, 95% CI 0.19 – 0.84). To test whether this association could be attributed to familiarity, we added two variables to the model - frequency of talking with the network member and level of trust - and the effect remained significant.

4. Discussion

Our study of young PWID from both urban and suburban areas of a large metropolitan city reports novel data on the behavioral and geographic characteristics of this population and their injection networks. As in prior studies (Armstrong, 2007; Broz and Ouellet, 2008; Broz et al., 2014; Garfein et al., 1998; Hahn et al., 2010; Neaigus et al., 2006; Ochoa et al., 2001; Prussing et al., 2014; Pugatch, 2006), our study showed that young PWID are likely to be non-Hispanic white (71%), even though our recruitment sites were located in urban, predominantly African American and Hispanic neighborhoods. A main finding of our study is that homelessness and residential transience are integral components of HCV and HIV risk, mediated through network size and syringe sharing. While homelessness (Ennett et al., 1999; Latkin et al., 1998b; Marshall et al., 2009; Metraux et al., 2004; Stein and Nyamathi, 2004) and housing instability (Corneil et al., 2006; Weir et al., 2007), including residential transience (German et al., 2007; Roy et al., 2014), are known predictors of HIV/HCV risk among PWID, less attention has been paid to residential transience among PWID that occur between settings with high and low levels of HIV/HCV prevalence.

Our study showed high levels of residential transience (59%) among young PWID, with a substantial sub-group (i.e., cross-over transients) who may pose heightened risk for HIV/HCV transmission. We suggest that this phenomenon may partly be driven by structural factors (e.g., locations of drug markets/SEPs relative to one's residence) that

increase the geographic mobility of this population. For instance, participants reported purchasing drugs in mostly (92%) urban areas in the past year (data not shown). As such, residents who do not live exclusively in urban areas (64%) may travel long or inconvenient distances to purchase drugs. Over time, this practice may become impractical and these individuals may become more likely to take up residence in urban areas. This transition is particularly probable for homeless persons who are not based in urban areas (81% of crossover transients and 33% of suburban only residents), who may more readily find resources (e.g., shelter, income generation activities) in urban areas. Our data provides some support for this hypothesis. We collected the dates and locations of all residences in the past year, and this information suggested that the mostly suburban-born cross-over transients showed a trend of taking up residence in urban areas over time (data not shown). In addition, the SEP sites where most of our recruitment efforts were focused are also located in these urban areas and may provide a resource to this group that is not readily available in suburban locations. Moreover, like homelessness, residential transience among young PWID is likely related to housing instability; however, transience may also reflect intentions to improve one's living situation (e.g., leave abusive home) or improve access to drugs (German et al., 2007; Roy et al., 2014), both of which are supported by qualitative interviews collected in this study (data not shown).

In a multivariable population-averaged GEE model, we found that syringe sharing was more common among cross-over transients, and this effect became even more apparent when network characteristics were included in the model (Table 4). This finding indicates that elevated syringe sharing by cross-over transients was not due to the composition of their core drug-using networks, although participants were also more likely to report sharing with a cross-over transient network member and were least likely to report sharing with urban only residents. Furthermore, other than living in the same household, geographic proximity (i.e., living less than 5 miles from network members) was not a predictor of sharing syringes with network members. This findings also point to the importance of considering the role of social geography and space in influencing syringe sharing as reported in recent studies (Hahn et al., 2008; Latkin et al., 1996; Martinez et al., 2014; Wylie et al., 2007).

Our study showed that the higher likelihood of syringe sharing among HCV-positive PWID was diminished after adjusting for network composition, including network HCV status (see model 1 vs. model 2, Table 4). Since all data on network members is provided by the participant (i.e., by proxy), this finding suggests that the perceived HCV status of one's partner may be an important predictor of risk behaviors within young PWID partnerships as previously reported (Hahn et al., 2010). Consistent with much past research (Davey-Rothwell and Latkin, 2007; Gollub et al., 1998; Latkin et al., 1998a; Miller and Neaigus, 2001; Tracy et al., 2014), women were more likely to share syringes with male partners, many of whom are also sex partners, after adjusting for participant and network characteristics (Table 4). Gender-specific interventions for PWID are needed to address this overlap in the sexual- and drug-using networks among women that enhances risk for HIV and other infections.

Our study had several limitations. First, the cross-sectional design hinders determination of a causal association between examined factors and the outcomes (i.e., network size and

syringe sharing). Second, data on participants were self-reported and collected through face-to-face interviews and, therefore, may be subject to socially desirable responding and recall errors. Third, proxy data from egos on network members may be inversely related to the strength of the relationship with the network member. However, the median network size was 3 and highly reliable measures of network density and composition are expected for up to 5 network members (Marsden, 1993).

Our study is one of few to simultaneously examine the role of individual, drug-using network and geographic mobility characteristics on the risk for syringe sharing among young, predominantly suburban PWID. Independent of homelessness and drug-using network characteristics, our study showed that geographic mobility between suburban and urban locations is a significant risk factor for syringe sharing. Our study highlights the need for interventions to improve housing stability and enhance access to resources (e.g., clean syringes) among young cross-over transients who are mostly homeless. Given that populations in low-income urban locales typically have a higher prevalence of HIV and HCV infections than do suburban populations, and that syringe sharing was more common with persons who resided in both urban and suburban areas within a 12 month period, this crossover transient group represents considerable potential for spreading infections to populations of suburban PWID. Further research is needed to understand the role of socio-geographic factors promoting higher infection risk among young PWID.

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Highlights

- Young persons who inject drugs (PWID) from both urban and suburban areas are mostly non-Hispanic white (71%).
- Homelessness was significantly ($p<.05$) associated large injection network size.
- HCV negative PWID share with fewer ($p<.01$) network members than their counterparts.
- Syringe sharing was high among PWID among transients who resided in both urban and suburban areas.

Table 1

Sociodemographic characteristics of young persons who inject drugs from metropolitan Chicago (N = 164)

	Ego	
	N	**%**
Place of birth [§]		
Urban Chicago[*]	31	30
Suburban Chicago[‡]	60	58
Out-of-state	6	12
Multiple places of residence in past year (i.e., transient)	97	59
Location(s) of residence(s) in past year		
Urban Chicago[*] only	59	36
Suburban Chicago only [**]	61	37
Both (i.e., cross-over transient) [‡]	44	27
Age (Mean, Median)	26.0,	26.0
18-24	54	33
25-30	110	67
Gender		
male	106	65
female	56	34
transgender	1	1
Race/ethnicity		
NH-white	117	71
Hispanic (all) [†]	26	16
NH-black	7	4
mixed/other races	14	9
Marital status		
single	133	81
married	14	9
divorced/separated	17	10
Employed with a regular job	73	45
Homeless in past 6 mo	85	52

[§] Place of birth was only available for representative sample (n=104; 63%).

[*] Urban residents are those who lived within the city limits of the city of Chicago, Illinois.

[**] Suburban residents are those who live outside the city limits of Chicago, but within the state of Illinois.

[‡] Cross-over transients were individuals who reported multiple residences in the past year that were located in both urban and suburban areas.

[†] Most were Mexican (59%) or Puerto Rican (32%).

Table 2

Drug use and risk behaviors of young persons who inject drugs from metropolitan Chicago (N = 164)

	Ego	
	N	**%**
Injected daily	131	80
How often inject per day		
about once	6	4
2-4	113	69
5-9	39	24
10 or more	6	4
Years injecting (mean, med, range)	6.0, 6.0, 0-14	
Inject multiple types of drugs in past 6 mo	54	33
Drugs injected past 6 months		
heroin by itself	163	99
multiple drugs	54	33
heroin with cocaine (speedball)	31	19
cocaine or crack	44	27
amphetamines or methamphetamine	8	5
How often shoot up with others		
never	21	13
less than half the time	52	32
half the time or more	91	55
Who inject most often with		
no one	21	13
sex partner	51	31
friends/acquaintances	84	51
other (parent, relatives, no relation)	8	5
How often inject with new syringe		
always	30	18
not always	134	82
How often inject with used syringe		
never	112	70
sometimes	49	30
How often backload †		
never	119	74
sometimes	42	26
Where obtain syringes		
syringe exchange program	69	42
pharmacy	88	54
other	7	4
Sex partner who injects drugs (multiplexity)	69	54

	Ego	
	N	**%**
Ever tested for HCV	117	71
Self-reported HCV-infected ‡	15	13

† Shoot up with a syringe after someone else has squirted drugs into in from their needle.

‡ Among those with test results.

Table 3

Core drug use network (n=565) features, by select characteristics of young persons who inject drugs (ego) (n=148)

Ego characteristic		N	Mean core network size	Mean % of network with homologous trait	% of network sharing needles
All		148	3.8		
Age	18-24 yrs old	49	3.7	42%	19%
	25-30 yrs old	99	3.9	37%	14%
Gender	Male	93	4.0	70%	13%
	Female	54	3.5	36%	21%
	Transgender	1	6.0	0%	17%
Race/ethnicity	NH-white	105	3.8	80%	17%
	Hispanic (all)	24	4.2	35%	9%
	NH-black/mixed/other	19	3.5	12%	17%
Location(s) of residence(s)	Urban only	51	3.5	70%	10%
	Suburban only	57	3.6	78%	15% [§]
	Both (crossover)	40	4.5	11%	23%
Homeless [a]	No	71	3.3 [†]	95%	16%
	Yes	75	4.4	18%	16%
HCV status	HCV positive	14	5.0	23%	32%
	HCV negative	94	3.6	66%	9% [**]
	Unknown	40	3.8	48%	25%

[†] IRR = 1.35, z = 2.56, p = .010.

[§] Kruskal-Wallis chi-squared = 8.20, 2df, p = .017.

[**] Kruskal-Wallis chi-squared = 12.80, 2 df, p = .002.

[a] 2 observations missing.

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Table 4

GEE logistic regressions predicting syringe sharing with network members

	GEE Model 1 (N = 145; obs = 554)			GEE Model 2 (N = 144; obs = 545)		
	OR	**95% Conf. Int.**		**OR**	**95% Conf. Int.**	
Respondent characteristics						
Gender: Female vs. Male	1.79	0.90	3.55 †	3.29	1.36	7.94 ** *b*
Age 25-30 vs. 18-24	1.01	0.53	1.91	1.05	0.47	2.36
Race/ethnicity (Reference: NH White)						
Hispanic	0.50	0.20	1.25	0.55	0.18	1.67
NH Black/Other	1.72	0.56	5.26	2.04	0.55	7.60
Homeless in past year	0.52	0.25	1.07 †	0.38	0.17	0.84 *
Location(s) of residence(s)						
Suburban only vs. Urban only	1.20	0.53	2.68	0.69	0.23	2.08
Both (cross-over) vs. Urban only	2.54	1.08	5.94 *	2.91	1.06	8.03 *
Both (cross-over) vs. Suburban only	2.12	0.96	4.68 †	4.19	1.69	10.35 **
HCV status (Reference HCV negative)						
HCV positive	2.84	1.11	7.30 *	1.83	0.56	5.95
HCV unknown	3.02	1.46	6.24 **	4.62	1.79	11.92 **
Network member characteristics [a]						
Gender: Female vs. Male				1.34	0.62	2.89 *c*
Respondent female network member female				0.26	0.09	0.75 *
Multiplexity: network member is also sex partner				2.10	0.99	4.46 †
Race/ethnicity (Reference: NH White)						
Hispanic				0.70	0.28	1.74
NH Black				1.28	0.52	3.16
Mixed/Other				1.23	0.41	3.72
Age (Reference 17-24)						
25-29				1.31	0.68	2.56
30-34				0.65	0.26	1.61

	GEE Model 1 (N = 145; obs = 554)		GEE Model 2 (N = 144; obs = 545)		
	OR	**95% Conf. Int.**	**OR**	**95% Conf. Int.**	
35+			0.32	0.11	0.87
Geographic proximity (Reference: > 5 miles apart)					
Same household			4.17	2.07	8.42 ***
Same area of town/within 5 miles			1.08	0.57	2.05
Location of residence(s)					
Suburban only vs. Urban only			3.01	1.32	6.89 **
Both (cross-over) vs. Urban only			4.94	2.17	11.23 ***
Both (cross-over) vs. Suburban only			1.64	0.73	3.67
Homeless in past year			1.00	0.42	2.38
HCV status (Reference: HCV negative)					
HCV positive			2.40	0.88	6.59 †
HCV unknown			0.40	0.19	0.84 *

[a] As reported by respondent.

[b] Effect of respondent gender=female when network member is male.

[c] Effect of network gender=female when respondent is male.

† p < .10

* p < .05

** p < .01

*** p < .001.

Note: 1 transgender ego excluded; 2 individuals dropped due to missing data on homelessness; 1 ego with only (1) transgender alter excluded in Models 2 and 3.

Abbrev: NH, non-Hispanic; HCV, hepatitis C.