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Injecting Risk Behavior among Traveling Young Injection Drug Users: Travel Partner and City Characteristics

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ABSTRACT *Young injection drug users (IDUs), a highly mobile population, engage in high levels of injecting risk behavior, yet little is understood about how such risk behavior may vary by the characteristics of the cities to which they travel, including the existence of a syringe exchange program (SEP), as well as travel partner characteristics. In 2004–2005, we conducted a 6-month prospective study to investigate the risk behavior of 89 young IDUs as they traveled, with detailed information gathered about 350 city visits. In multivariable analyses, travel to larger urban cities with a population of 500,000–1,000,000 was significantly associated with injecting drugs (adjusted odds ratio (AOR)= 3.71; 95 % confidence interval (CI), 1.56–8.82), ancillary equipment sharing (AES; AOR= 7.05; 95 % CI, 2.25–22.06) and receptive needle sharing (RNS; AOR=5.73; 95 % CI, 1.11–27.95), as compared with visits to smaller cities with populations below 50,000. Region of the country, and the existence of a SEP within the city visited, were not independently associated with injecting drugs, AES, or RNS during city visits. Traveling with more than one injecting partner was associated with injecting drugs during city visits (AOR= 2.77; 95 % CI, 1.46–5.27), when compared with traveling alone. Additionally, both non-daily and daily/almost daily alcohol use during city visits were associated with AES (AOR=3.37; 95 % CI, 1.42–7.68; AOR=3.03; 95 % CI, 1.32–6.97, respectively) as compared with no alcohol consumption. Traveling young IDUs are more likely to inject when traveling with other IDUs and to engage in higher risk injection behavior when they are in large cities. Risk behavior occurring in city visits, including equipment sharing and alcohol consumption, suggests further need for focused interventions to reduce risk for viral infection among this population.*

KEYWORDS *Young IDUs, Travelers, Injecting risk, Ancillary equipment sharing, Receptive needle sharing, City characteristics, Travel partners*

INTRODUCTION

Young and newly initiated drug users, in particular injection drug users (IDUs), demonstrate increased risk behavior for viral infection, including hepatitis C virus

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(HCV) and human immunodeficiency virus (HIV), as compared with their older and more experienced counterparts.[1] Studies of young IDU over the past decade have found HCV prevalences in the range of 35–47 %[2–5] and HIV prevalences from 2.3–5.3 %.[2,6]

Young drug users are also highly mobile and thus present a challenge to study tracking and retention,[2,7] but recent research has suggested that the travel of young IDUs across a variety of geographic locations, including urban and rural areas of the USA, may contribute to the spread of viral infections such as HCV and HIV.[2,8,9] However, studies have used planned travel as an exclusion criterion for retention purposes, suggesting that a significant gap in knowledge exists about this population.[2–5,10,11] We have previously observed high levels of risk behavior among mobile young IDUs; however, we do not know if this risk behavior is a trait of those who travel and/or if it is influenced by the environment of the cities to which they travel.[2] Further understanding of how risk behavior differs relative to location may aid in designing interventions to prevent blood-borne viral acquisition and transmission among this population.

Syringe exchange programs (SEPs) provide sterile syringes as well as ancillary injection equipment with the goal of reducing blood-born infections, and are largely concentrated in large, urban cities across the country (D. Purchase, written and oral personal communication, March 2010). A recent review by Palmateer et al. of the effectiveness of SEPs for prevention of HIV and HCV concluded that SEPs have positively impacted self-reported injection risk behavior among IDUs in the last decade, and a review by Holtzman et al. has shown an indirect protective effect of SEP use on HCV infection.[12,13] Little research exists, however, directly comparing injection risk behavior where SEPs do and do not exist. Given the high rate of travel in young IDUs and the level of risk behavior of traveling IDUs, our main goal was to determine whether injecting risk behavior varies by the availability of SEPs. We hypothesized that injecting risk may vary by city characteristics such as size and location, based on the previous findings that cities themselves may be correlates of viral infection.[14] In addition to geographic factors, recent research on the social network characteristics of youth have shown the power of social groups to both encourage and protect against sexual and drug risk behavior.[15] A cross-sectional analysis of young IDUs partnerships has shown that having an injecting partner who is known to be HCV positive was associated with decreased receptive needle sharing (RNS).[16] However, other studies show increased RNS and ancillary equipment sharing (AES) among sexual partners independent of partner serostatus.[17] A secondary goal of this study, therefore, was to investigate whether the risk behavior of traveling young IDUs is associated with the characteristics of their travel partners.

METHODS

Overview

In 2004–2005, we conducted a prospective study of self-identified traveling young drug users known as the ORBIT Study. This study was one of a constellation of studies of young IDUs in San Francisco collectively known as the "UFO Study."[2,6,16,18–20] Structured interviews were conducted at baseline, and 3 and 6 months after enrollment. HIV and HCV serology data were not obtained as part of this study, due to the complexity of results disclosure while traveling. All study

protocols were approved by the Institutional Review Board of the University of California, San Francisco.

Study Participants

Participants were recruited from four community-based UFO study sites in San Francisco, located in the Mission District, Tenderloin, South of Market, and Haight–Ashbury neighborhoods. UFO study participants were recruited by street outreach methods in areas where young IDUs were known to congregate. UFO study participants and persons inquiring about study eligibility at the study site were screened for ORBIT Study participation. Persons were eligible for participation if they were under 30 years of age, reported drug use (including non-injection drugs) in the prior 30 days, had traveled outside of the San Francisco Bay Area for at least one night in the prior 90 days, and had plans to leave the Bay Area in the upcoming 30 days.

Study Procedures

After an informed consent process, participants completed a baseline interview online, utilizing a custom-written web-based personal interviewing computer program. A research assistant provided assistance with operating the program and conducted the interview in person with the participant if needed. Participants were asked for contact information for tracking and retention purposes and to complete follow-up interviews at 3 and 6 months post-baseline. These follow-up interviews could be self-completed online or completed over the phone with an interviewer. Participants were also asked to update their contact information, in person or on the phone monthly, on non-interview months.

At the time of enrollment, participants were issued an automated teller machine (ATM) card to be used for study reimbursement while traveling. At the end of the baseline interview, the research assistant accompanied participants to the nearest ATM to assist in activating the card and withdrawing cash for the baseline visit, to ensure familiarity with the card for follow-up reimbursements. Study staff also maintained a toll free phone number which participants could call to complete follow-up interviews, to check in on non-interview months, or to report interview completion in order to receive payment via ATM card. Participants were paid $20 for baseline and follow-up interviews and $10 for check-ins.

Study Measures

Interview domains for the baseline and follow-up interviews included participant demographics; drug and alcohol consumption; injecting practices and sexual behavior; history of travel as well as recent travel. Recent travel focused on the cities in which the participant had spent the most time in the prior 3 months. During each interview, participants were asked about travel partners and drug and alcohol use within each of the two cities in which they had stayed for the longest number of consecutive days in the prior 3 months.

Dependent Variables Dependent variables were (1) injecting drugs (yes/no), (2) AES (yes/no), and (3) RNS (yes/no) while in the cities visited for the longest duration. AES was defined as sharing cookers or baggies in which drugs are dissolved and divided for use with other IDUs.

Independent Variables The primary independent variable was the existence of a SEP during the time of the study in the identified city. We determined the existence of SEPs using the January 2005 North American Syringe Exchange Network (NASEN) directory (unpublished), compiled from NASEN's national survey of syringe exchange programs in 2004 (D. Purchase, personal communication).

We also examined rural or smaller cities versus larger metropolitan areas. We utilized 2004 population estimates from the US Census Bureau for each city visited by study participants and categorized city size into four groups based roughly on "core-based statistical area" (CBSA) classifications: cities with a population under 50,000, cities with a population between 50,000 and 500,000, cities with a population between >500,000 and 1,000,000, and cities with a population greater than 1,000,000.[21] While the CBSA definitions classify all regions with populations between 50,000 and <1,000,000 as "macropolitan," applying this general category to our data would have lumped >70 % of all city visits made by study participants into a single group. Because the median population size for the cities with populations over 50,000 visited by our participants was 511,747, we split the macropolitan category at 500,000, creating two macropolitan groups based on city size.

Finally, we investigated the characteristics of the persons with whom participants had traveled in the prior 3 months. Among those who traveled with others, we assessed the number of travel partners, whether those partners were also injecting and/or sexual partners, and the gender of the travel partners for each city visit.

Covariates We examined other variables as possible confounders of injecting and injecting risk behavior. These variables included age, sex, and race/ethnicity of the participant, alcohol consumption during city visits, and the main type of drug the participant injected during city visits. For alcohol consumption, we created three categories based on participant responses: daily/almost daily, defined as alcohol consumption on >80 % of the days during a city visit; non-daily, defined as alcohol consumption on up to 80 % of the days during a city visit; and none, defined as no alcohol consumption during a city visit.

Statistical Analyses

Because we were interested in injecting risk behaviors, we limited the analyses to current IDUs, i.e., those participants who reported any injection behavior in the 3 months prior to any of the three interviews. We calculated frequency distributions for categorical variables and medians and interquartile ranges (IQRs) for continuous variables. We calculated odds ratios for the association between each of the independent variables and other covariates of interest with the three dependent variables in bivariate and multivariate analyses using generalized estimating equation (GEE) methods with the logistic link and an independent correlation matrix to adjust for the correlation between multiple cities reported by the same participant over multiple study visits. The unit of analysis was each of the two cities in which the participant reported spending the most time at each interview (up to three), for a maximum of six "city visits" per study participant over the course of study enrollment.

Analysis of injection drug use was conducted for all city visits, while analyses of AES and RNS were limited to those city visits in which injecting occurred. For multivariate modeling, we included all covariates with at least one level that was significantly associated ($p<0.05$) with any of the three dependent variables in the bivariate analyses. We chose this strategy so that we could compare measures of

association across the three outcomes of interest. We reduced the crude multivariate models, excluding covariates which had no levels significantly associated with any of the outcomes in the multivariate models. Gender, age, and race/ethnicity were forced into all multivariate models.

RESULTS

Sample Characteristics

Baseline Characteristics and Behaviors Ninety-seven persons were initially enrolled in the study; 89 (92 %) were current IDUs and were included in the final analyses. Fifty-nine (66 %) were male, 26 (29 %) were female, and four (5 %) were transgender (Table 1). The median age was 23 years (IQR, 20–26). Most study participants (82 %) identified their race/ethnicity as white. Almost all study participants (92 %) considered themselves to be "travelers." A majority (80 %) reported that they did not have a permanent home to which they could return if desired.

At baseline, 59 % of participants reported traveling to three or more cities in the prior 3 months. The main modes of travel between cities were hitchhiking (62 %) and public transit (51 %), with 41 % of participants reporting "train hopping" (riding illegally in freight or railway cars) as an additional mode of travel. The majority of participants (84 %) reported traveling with at least one other person in the prior 3 months. Of those participants who traveled with others, 82 % reported traveling with at least one injecting partner, and 73 % reported traveling with at least one sex partner.

Most of the participants (88 %) reported alcohol use in the prior 3 months, with a median number of drinks per drinking day of 5 (IQR, 2–8) among those who did drink. Most participants (86 %) reported using heroin (injected or otherwise) or methadone, amphetamine or methamphetamine (82 %), crack (57 %), and cocaine (53 %). The median number of years since first injecting was 5 (IQR, 3–8). Nearly half of the respondents (46 %) engaged in RNS in the 3 months prior to baseline, and 70 % engaged in AES.

Follow-up Out of 89 IDUs, 63 (71 %) persons completed the 3-month interview, 56 (63 %) completed the 6-month interview, and detailed city-level data were obtained for 350 city visits overall. Of the individuals lost to follow-up, there were no significant differences (using the Chi-square test, p values (all)>0.05) in terms of gender, age, ethnicity, self-identification as a traveler, and baseline prior 3-month drug and alcohol use, receptive needle sharing, ancillary equipment sharing, incarceration, number of cities visited, and number of travel partners.

City Visit Characteristics and Behaviors The cities in which participants spent the most time were predominantly in the Western USA (California, Oregon, and Washington states, 84 %) (Table 2). Most (85 %) of the cities listed had a population of 50,000 or larger, and 10 % of reported city visits were to a city with a population of >1,000,000. Over two thirds (69 %) of the city visits were to cities that had a SEP at the time of the visit.

Participants reported injection drug use in 200 (59 %) of the city visits, and AES and RNS were reported in 47 and 33 % of these visits, respectively.

TABLE 1 ORBIT study baseline characteristics including demographics, recent travel history and drug use ($n=89$)

Characteristic	Total (n (%))
Participant characteristics	
All	89 (100.0)
Gender	
Male	59 (66.3)
Female	26 (29.2)
Transgender/other	4 (4.5)
Age (years)	
15–19	18 (20.2)
20–24	47 (52.8)
>24	24 (27.0)
Race/ethnicity	
White	73 (82.0)
All other/non-white	16 (18.0)
Self-identified as a traveler	
Yes	82 (92.1)
No	6 (6.7)
Do not know	1 (1.1)
Permanent home	
Does not have a permanent home to return to	71 (79.8)
Does have a home to return to	18 (20.2)
Sources of income (prior 3 months)	
Panhandling	57 (64.0)
Stealing	27 (30.3)
Money from friends/partners/parents/relatives	37 (41.6)
Hustling or prostitution	17 (19.1)
Job	24 (27.0)
Benefits—general assistance, social security insurance, etc.	16 (18.0)
Selling drugs	32 (36.0)
Other	15 (16.9)
Modes of travel (prior 3 months, more than one possible)	
Hitchhiking	55 (61.8)
Train hopping	36 (40.5)
Car	41 (46.1)
Public transit (paid)	45 (50.6)
Other	10 (11.2)
Number of cities visited (prior 3 months)	
1–2 cities	37 (41.6)
3–4 cities	27 (30.4)
5 or more cities	25 (28.1)
Incarceration in jail or juvenile hall (prior 3 months)	
Yes	33 (37.5)
No	55 (62.5)
Alcohol use (prior month)	
Daily/almost daily	31 (37.4)
Non-daily	42 (50.6)
None	10 (12.1)
Number of drinks per typical drinking day, median (IQR; among those reporting any alcohol consumption, prior month)	5.0 (2.0–8.0)
Drug use (prior 3 months, more than one possible)	
Marijuana, hallucinogens, opiates, or benzodiazepines	86 (97.7)
Heroin/methadone	76 (86.4)
Speed	72 (81.8)

TABLE 1 (continued)

Characteristic	Total (*n* (%))
Crack	50 (56.8)
Cocaine	47 (53.4)
Years since first injection, median (IQR)	5.0 (3.0–8.0)
Ancillary equipment sharing (prior 3 months)	
Yes	59 (70.2)
No	25 (29.8)
Receptive needle sharing (prior 3 months)	
Yes	39 (46.4)
No	45 (53.6)
Travel partner characteristics	
Number of travel partners (prior 3 months)	
0	14 (15.9)
1	20 (22.7)
>1	54 (61.4)
Travel partner characteristics among those reporting any travel partners (prior 3 months, $n=74$)	
Number of male travel partners	
0	8 (10.8)
1	19 (25.7)
>1	47 (63.5)
Number of female travel partners	
0	28 (37.8)
1	23 (31.1)
>1	23 (31.1)
Number of transgender/other travel partners	
0	70 (94.6)
1	2 (2.7)
>1	2 (2.7)
Age of youngest travel partner	
Under 20 years	36 (50.0)
20–24 years	25 (34.7)
25 years and over	11 (15.3)
Age of oldest travel partner	
Under 20 years	2 (2.7)
20–24 years	22 (29.7)
25 years and over	50 (67.6)
Number of travel partners who were also injection partners	
0	13 (17.6)
1	20 (27.0)
>1	41 (55.4)
Number of travel partners who were also sex partners	
0	20 (27.0)
1	31 (41.9)
>1	23 (31.1)

Bivariate Results

Bivariate Associations with Participant Characteristics There were no significant associations between the outcome variables and self-identification as a traveler, homelessness, incarceration, or the number of cities visited in the prior 3 months (Table 3). Transgender participants had higher odds of injecting drugs during city visits compared with male participants. Compared with those who were 25 years or

TABLE 2 City characteristics and injecting behaviors in the two cities visited for the longest duration, in the 3 months prior to interview ($n=350$)

Characteristic	Total (n (%))
US region	
West	293 (84.4)
Midwest	23 (6.6)
East	31 (8.9)
Rural/urban setting (city population size)	
<50,000	51 (14.7)
50,000–500,000	130 (37.5)
> 500,000–1,000,000	133 (38.3)
>1,000,000	33 (9.5)
Syringe exchange program available in this city	
Yes	239 (68.9)
No	108 (31.1)
Participant injected in this city	
Yes	200 (58.5)
No	142 (41.5)
Ancillary equipment sharing (among city visits in which the participant injected)	
Yes	93 (46.5)
No	107 (53.5)
Receptive needle sharing (among city visits in which the participant injected)	
Yes	65 (32.5)
No	135 (67.5)
Daily injecting (among city visits in which the participant injected)	
Yes	105 (52.5)
No	95 (47.5)
Alcohol use in city visits	
Daily/Almost daily	102 (32.0)
Non-daily	93 (29.2)
None	124 (38.9)

older, participants who were 19 years old or younger had an increased odds of engaging in AES during their city visits. Participants who reported their race/ethnicity as non-white had a decreased odds of engaging in AES, compared with self-identified white study participants. Alcohol use was associated with AES: participants reporting daily/almost daily alcohol use had an increased odds of AES, while participants who reported non-daily alcohol use had an even greater odds of AES when compared with participants who did not consume alcohol.

Bivariate Associations with City Characteristics There was a decreased odds of having injected during city visits occurring in the Midwest, compared with cities in the Western USA (Table 3). There was an increased odds of having injected, engaged in AES, and engaged in RNS for visits to cities with a population between >500,000 and 1,000,000, compared with cities under 50,000. Among visits to cities with a SEP, compared with those cities without a SEP, there was a significantly increased odds of injecting drugs.

Bivariate Associations with Travel Partner Characteristics There were no significant associations between the outcome variables and the age, gender or number of travel partners within city visits. Additionally, traveling with a sexual partner was

TABLE 3 Unadjusted odds ratios and 95 % confidence intervals for injecting risk behaviors in the two cities visited for the longest duration (prior 3 months)

	Injecting status (yes/no)			Ancillary equipment sharing (yes/no)			Receptive needle sharing (yes/no)		
	Among all city visits ($n=350$)			Among city visits where injecting was reported ($n=200$)					
Characteristic	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value
Participant characteristics									
Gender									
Male	1.00			1.00			1.00		
Female	1.06	(0.59, 1.92)	0.84	1.86	(0.87, 3.99)	0.11	1.57	(0.79, 3.14)	0.20
Transgender/other	3.83	(1.08, 13.56)	0.04	0.92	(0.44, 1.92)	0.83	0.35	(0.05, 2.56)	0.30
Age									
≥25 years	1.00			1.00			1.00		
20–24 years	0.85	(0.44, 1.65)	0.63	0.89	(0.41, 1.93)	0.76	1.03	(0.46, 2.29)	0.94
≤19 years	0.99	(0.41, 2.36)	0.98	2.46	(1.06, 5.71)	0.04	1.71	(0.66, 4.45)	0.27
Race/ethnicity									
White	1.00			1.00			1.00		
Race other than white	0.80	(0.37, 1.76)	0.59	0.31	(0.11, 0.89)	0.03	0.51	(0.19, 1.37)	0.18
Self-identified as a traveler	0.76	(0.18, 3.14)	0.70	0.48	(0.15, 1.52)	0.21	0.56	(0.11, 2.93)	0.49
Did not have a permanent home to return to	1.53	(0.85, 2.74)	0.16	1.33	(0.53, 3.30)	0.54	1.88	(0.80, 4.46)	0.15
Incarcerated in jail or juvenile hall (prior 3 months)	1.78	(1.00, 3.17)	0.05	1.23	(0.63, 2.39)	0.55	0.89	(0.47, 1.66)	0.71
Injected daily				1.19	(0.63, 2.24)	0.59	0.63	(0.33, 1.18)	0.15
Alcohol use									
None	1.00			1.00			1.00		
Non-daily	1.07	(0.57, 2.00)	0.84	3.67	(1.78, 7.55)	<0.01	1.70	(0.69, 4.17)	0.25
Daily/almost daily	1.06	(0.57, 1.97)	0.86	2.41	(1.15, 5.08)	0.02	1.27	(0.53, 3.06)	0.60
Number of cities visited (prior 3 months)									
1–2	1.00			1.00			1.00		
3–4	1.30	(0.71, 2.37)	0.40	0.89	(0.41, 1.91)	0.76	1.30	(0.60, 2.82)	0.51
≥5	0.96	(0.54, 1.73)	0.90	1.34	(0.61, 2.99)	0.47	1.97	(0.95, 4.12)	0.07

TABLE 3 (continued)

	Injecting status (yes/no)			Ancillary equipment sharing (yes/no)			Receptive needle sharing (yes/no)		
	Among all city visits ($n=350$)			Among city visits where injecting was reported ($n=200$)					
Characteristic	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value
City characteristics									
Region visited (excluding cities outside USA)									
West	1.00			1.00			1.00		
Midwest	0.36	(0.14, 0.92)	0.03	1.94	(0.58, 6.54)	0.28	0.31	(0.04, 2.70)	0.29
East	1.21	(0.57, 2.59)	0.62	0.95	(0.35, 2.56)	0.92	2.17	(0.76, 6.14)	0.15
Population									
<50,000	1.00			1.00			1.00		
50,000–500,000	1.74	(0.93, 3.25)	0.09	2.08	(0.68, 6.35)	0.20	3.29	(0.75, 14.51)	0.12
>500,000–1,000,000	7.48	(3.51, 15.92)	<0.01	4.10	(1.40, 11.96)	<0.01	4.69	(1.13, 19.45)	0.03
>1,000,000	2.63	(0.89, 7.81)	0.08	2.36	(0.62, 8.97)	0.21	2.68	(0.48, 14.83)	0.26
Syringe exchange program available	2.64	(1.56, 4.49)	<0.01	0.80	(0.42, 1.51)	0.49	0.96	(0.48, 1.92)	0.91
Travel partner characteristics									
Number of travel partners (prior 3 months)									
0	1.00			1.00			1.00		
1	0.72	(0.33, 1.58)	0.42	1.76	(0.66, 4.70)	0.26	1.56	(0.47, 5.13)	0.47
>1	0.95	(0.50, 1.79)	0.86	2.04	(0.85, 4.88)	0.11	2.48	(0.90, 6.82)	0.08
Number of male travel partners (prior 3 months)									
0	1.00			1.00			1.00		
1	0.52	(0.26, 1.04)	0.07	1.82	(0.77, 4.30)	0.17	2.03	(0.70, 5.89)	0.19
>1	0.94	(0.51, 1.73)	0.84	2.02	(0.99, 4.12)	0.05	2.43	(0.95, 6.20)	0.06
Number of female travel partners (prior 3 months)									
0	1.00			1.00			1.00		
1	0.91	(0.49, 1.68)	0.75	1.19	(0.52, 2.70)	0.68	1.35	(0.56, 3.27)	0.51
>1	1.57	(0.78, 3.13)	0.20	1.46	(0.64, 3.37)	0.37	1.09	(0.52, 2.32)	0.81
Age of youngest travel partner (prior 3 months)									
Under 20 years	1.00			1.00			1.00		

20–24 years	0.89	(0.47, 1.70)	0.73	1.42	(0.69, 2.93)	0.35	1.76	(0.83, 3.75)	0.14
25 and over	0.42	(0.16, 1.13)	0.09	0.53	(0.13, 2.07)	0.36	0.85	(0.21, 3.48)	0.82
Age of oldest travel partner (prior 3 months)									
Under 20 years	1.00			1.00			1.00		
20–24 years	1.38	(0.38, 4.99)	0.63	0.30	(0.03, 3.07)	0.31	1.55	(0.13, 19.14)	0.73
25 and older	1.39	(0.40, 4.89)	0.60	0.35	(0.03, 3.53)	0.37	1.82	(0.18, 18.52)	0.61
Number of travel partners who were also sex partners (prior 3 months)									
0	1.00			1.00			1.00		
1	0.73	(0.41, 1.30)	0.28	1.59	(0.67, 3.80)	0.30	1.60	(0.70, 3.65)	0.26
>1	1.46	(0.72, 2.96)	0.30	0.51	(0.21, 1.27)	0.15	0.73	(0.24, 2.16)	0.56
Number of travel partners who were also injecting partners (prior 3 months)									
0	1.00			1.00			1.00		
1	1.40	(0.76, 2.59)	0.28	2.30	(0.93, 5.72)	0.07	2.80	(1.10, 7.09)	0.03
>1	2.95	(1.63, 5.34)	<0.01	1.94	(0.89, 4.23)	0.10	2.23	(0.95, 5.27)	0.07

not associated with our outcomes of interest. There was an increased odds of engaging in RNS if a participant had traveled with one other injecting partner in the prior 3 months, and there was an increased odds of injecting in each city visit if traveling with more than one injecting partner.

Multivariate Results

Multivariate Associations with Participant Characteristics There were no significant associations between the outcome variables and participant age in the final multivariate models (Table 4). There were two gender-related findings: transgender status was independently associated with AES, and female status was associated with RNS. Race/ethnicity other than white was associated with decreased odds of AES. Alcohol use also remained associated with AES in the final multivariate model: both daily/almost daily alcohol use and non-daily alcohol use per city visit were independently associated with AES, when compared with no alcohol use.

Multivariate Associations with City Characteristics Travel to a city with a population between >500,000 and 1,000,000 was independently associated with increased odds of injecting drugs, AES and RNS when compared with visiting a city with a population of <50,000. Region of travel was not associated with the outcome variables in the final models, nor was SEP availability.

Multivariate Associations with Travel Partner Characteristics Traveling with more than one injecting partner was independently associated with increased odds of injecting drugs during city visits, compared with those with no travel/injecting partners, in the final multivariate models.

DISCUSSION

The traveling young IDUs in this study reported high levels of risk behavior, with 70 % engaging in AES and 46 % engaging in RNS in the 3 months prior to baseline, and they were more likely to inject drugs and to engage in AES and RNS when they were in larger, more urban cities than when they were in smaller towns and rural areas across the country. There may be a correlation between larger cities having more significant drug economies and a more easily accessible community of fellow users than smaller towns and rural areas, which could facilitate greater, and/or riskier, drug use. The association of increased injecting risk in visits to cities with a population larger than one million did not reach statistical significance, likely due to the small number of visits to such cities (33 visits). That larger, more urban cities are more likely to have SEP services available is an opportunity for SEP-based interventions to target injection risk among traveling young IDUs. However, we did not find an association between the existence of a SEP during city visits and injecting risk behavior in the final multivariate models, although the existence of an SEP was associated with increased odds of injecting drugs during city visits in bivariate analyses.

The association with injecting in city visits for participants who traveled with injecting partners in the prior 3 months is consistent with the existing literature on the social networks of young drug users.[15,22] The association between female gender status and RNS highlights gender differences in risk behavior among young IDUs previously described,[19] however the association between transgender status and AES

TABLE 4 Adjusted odds ratios and 95 % confidence intervals for injecting risk behaviors in the two cities visited for the longest duration (prior 3 months)

	Injecting status (yes/no)			Ancillary equipment sharing (yes/no)			Receptive needle sharing (yes/no)		
	Among all city visits with a city name recorded ($n=350$)			Among city visits in which the participant reported injecting and had a city name recorded ($n=200$)					
Characteristic	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value	Odds ratio	95 % confidence intervals	p value
Gender									
Male	1.00			1.00			1.00		
Female	1.11	(0.52, 2.40)	0.78	2.19	(0.86, 5.59)	0.10	2.56	(1.16, 5.66)	0.02
Transgender/other	6.35	(0.76, 52.95)	0.09	4.58	(1.04, 20.17)	0.04	0.81	(0.09, 7.15)	0.85
Age									
≥25 years	1.00			1.00			1.00		
20–24 years	0.63	(0.31, 1.29)	0.21	0.63	(0.23, 1.76)	0.38	0.68	(0.29, 1.62)	0.39
≤19 years	0.66	(0.23, 1.89)	0.44	0.99	(0.32, 3.06)	0.98	0.69	(0.22, 2.16)	0.52
Race/ethnicity									
White	1.00			1.00			1.00		
Race other than white	0.67	(0.28, 1.64)	0.38	0.19	(0.06, 0.55)	<0.01	0.50	(0.15, 1.65)	0.25
Population									
<50,000	1.00			1.00			1.00		
50,000–500,000	0.96	(0.47, 1.94)	0.91	1.77	(0.57, 5.46)	0.32	1.98	(0.41, 9.53)	0.39
>500,000–1,000,000	3.71	(1.56, 8.82)	<0.01	7.05	(2.25, 22.06)	<0.01	5.73	(1.17, 27.95)	0.03
>1,000,000	1.25	(0.40, 3.86)	0.70	3.84	(0.93, 15.84)	0.06	2.64	(0.45, 15.45)	0.28
Syringe exchange program available	1.78	(0.90, 3.52)	0.10	0.58	(0.23, 1.46)	0.25	0.86	(0.37, 2.04)	0.74
Alcohol use in this city									
None	1.00			1.00			1.00		
Non-daily	1.16	(0.61, 2.20)	0.66	3.37	(1.42, 7.68)	<0.01	1.19	(0.45, 3.13)	0.72
Daily/almost daily	1.21	(0.64, 2.26)	0.56	3.03	(1.32, 6.97)	<0.01	1.42	(0.58, 3.44)	0.44
Number of travel partners who were also injecting partners (prior 3 months)									
0	1.00			1.00			1.00		
1	1.46	(0.74, 2.89)	0.28	2.30	(0.84, 6.28)	0.10	1.61	(0.59, 4.39)	0.35
>1	2.77	(1.46, 5.27)	<0.01	1.51	(0.60, 3.84)	0.38	1.65	(0.66, 4.12)	0.28

represents an area of no previously published research. While our sample included only a small number of transgender participants, the results were consistent with the previous finding that transgendered persons are at increased risk for HIV associated with injecting history.[23]

Although not our main study hypothesis, we found a strong association between alcohol consumption and risky injection behavior during city visits. We previously found an independent association between heavy alcohol consumption and travel among young IDUs.[2] Together these results highlight the need for targeted prevention efforts which emphasize the risks of combining alcohol and injection drug use, for reduction in the transmission of viral infections in addition to overdose prevention among young IDUs.

Our findings are subject to several limitations, including the use of self-reported behavioral information, especially that which relates to stigmatized and/or illegal behavior. We used web-based surveys for baseline and follow-up interviews to improve self-report, and others have shown that information bias for sexual behavior variables might be mitigated through the use of such techniques.[24] Additionally, we used the city limits for defining whether a SEP was available, and did not consider the availability of SEP in neighboring cities. We also did not consider the level to which such services were available, including location, number of SEP sites within each city, program hours, and exchange policy (distribution versus one for one). It may be that these nuances (whether an exchange is open 1 day a week, or daily, and whether participants can pick-up unlimited supplies when they visit) have a greater impact on risk behavior than whether or not an exchange existed at all in a particular town at the time of visit. Specific information about the SEPs themselves could illuminate how injecting risks are affected by SEP location and service level for traveling IDUs who may have time and geographic constraints. In addition, we did not examine the effects of over-the-counter pharmacy sales of syringes and secondary exchange on injecting risk among traveling IDUs.

Finally, our sample size ($n=89$) is modest and as such does not make for clearly generalizable results. Other studies of young travelers have had comparable cohort sizes,[8,25–27] but all other studies have included young drug users generally while we focused solely on traveling IDU in our analysis. Our follow-up rates (71 % at 3 months and 63 % at 6 months) are also comparable to other studies of young travelers[7] although Des Jarlais et al.[25] have been able to achieve an 81 % follow-up rate at the 6-month mark. In general, follow-up rates for geographically stable young drug users range from 50–80 %, placing our results within this realm of outcomes.[18,25,28–30]

Moving forward, more research is needed about traveling IDUs and their risk for viral infection. That higher risk injection behavior is occurring in larger, more urban areas with more services available, including SEPs, is both good and bad news for the prevention of HCV and HIV among traveling young IDUs. The availability of services in larger cities may be the reason that such places have become frequent destinations for this population (as well as greater drug availability), or it may be that cities provide the exposure to opportunities that contribute to higher risk behavior among this population. SEPs are well positioned to specifically address syringe and ancillary equipment sharing, and a better understanding of their nuanced role in HIV/HCV prevention is critical in improving future interventions. Greater understanding of the impact of geographic and social network factors, as well as syringe and ancillary equipment availability, is vital for developing intervention strategies with traveling young IDUs.

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