

# Characteristics and Health Service Utilization in Two Samples of Young Injection Drug Users Recruited Using Direct and Referral Methods in San Francisco, California

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## Abstract

**Background:** Targeted sampling (TS) and respondent-driven sampling (RDS) methods are methods used to recruit 'hard-to-reach' populations. We examine similarities and differences in population characteristics and health service utilization, in two independent samples of young adult injection drug users (IDU).

**Methods:** Data from two samples of young adult (18-29 years) IDU sampled using RDS (N=31) and TS (N=97) in San Francisco, California were compared: (1) a cross-sectional study of IDU using RDS as part of the National HIV Behavioral Survey (NHBS) IDU-2 Study conducted by the San Francisco Department of Public Health, from May 2009 to December 2009; and (2) the UFO Study, an ongoing prospective study of young IDU that used TS methods to sample young IDU (<30 years) from May 2010 to December 2010.

**Results:** Compared to the TS sample, the RDS sample was more heterogeneous demographically: a higher proportion of women, and racial/ethnic diversity; a significantly larger proportion of the RDS sample (vs. TS) previously received an HIV test (98.6% vs. 88.5%) whereas the TS sample had a significantly higher prevalence of HCV (58.7% vs. 15.1%).

**Conclusion:** TS and RDS reached a similar cross section of the young adult IDU population in San Francisco; however, some notable differences were observed, especially in HCV infection prevalence. The findings highlight the need for continued efforts to improve sampling strategies aimed high risk IDU, so as to inform both public health surveillance, research and prevention interventions.

**Keywords:** Injection drug users; HCV infection

## Introduction

Targeted sampling (TS) and respondent-driven sampling methods (RDS) are commonly used methods to sample 'hard-to-reach' populations, like injection drug users (IDU). There are notable differences between each: TS uses street-based and community based outreach, informed by ethnographic data to locate and recruit a target population [1], but lacks statistical methods to correct for potential biases. RDS is a modified snowball sampling method that utilizes a dual-incentive chain referral system through controlled coupons where waves of recruitment are used to penetrate a population until sample size and stability are achieved; wherein specialized estimators are used to adjust for biases in the probability of inclusion and recruitment patterns [2]. Neither method is guaranteed nor absolute in their attempt to collect generalizable data, but both are motivated by the need for sampling methods that can be used to design and improve disease surveillance and public health interventions [1-4]. Kral et al. [5] recently compared characteristics and self-reported service utilization of adult IDU in San Francisco from two studies that used TS and RDS, respectively. They found that there were similarities across all demographics except the African American race as well as age. Risk behaviors were also similarly distributed in the two samples, but a lower proportion of the RDS sample accessed drug treatment, syringe exchange programs (SEP), and also had lower self-reported prevalence of hepatitis C virus (HCV) infection. This comparison however, was limited, as few young adult IDU were included; the majority ( $\geq 85\%$ ) were 36 years or older. While San Francisco's general population is mostly white (48.5%) and Asian (34.2%) [6], surveillance studies depict an IDU population comprised of mostly non-Hispanic Whites (40.5%) and African Americans

(32.6%) individuals in San Francisco [7]; however, the demographics of national samples depict an IDU population comprised of mostly African Americans (49%) and fewer non-Hispanic Whites (25%) [8].

Herein we build upon the findings reported by Kral et al. [5] by examining data from two independent samples of young adult IDU, aged 18-29 years in San Francisco. The first sample is from the UFO Study, which utilized TS methods to enroll young IDU into a prospective observational cohort study of HCV risk and incidence [9]. The second sample utilized RDS to recruit IDU aged  $\geq 18$  years for a study conducted by the San Francisco Department of Public Health (SFDPH) as part of the National HIV Behavioral Surveillance System (NHBS IDU-2) [10]. The aim of this paper is to compare and contrast the two independent samples of young injectors. Young and recent initiates to injecting are particularly susceptible to HCV infection where a quarter of young IDU are infected within two years of initiating [11,12]. Results from this analysis may help inform approaches to research and interventions aimed at young IDU.

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## Methods

### Study samples

The UFO Study utilized TS methods to recruit and sample young IDU, over several waves, from 1997 to 2010; results and methods have been described in detail elsewhere [9,11]. In brief, research staff conducted street-based outreach to locate and invite prospective study subjects from neighborhoods where young IDU were known to congregate. Young IDU were invited to fixed site locations where they were screened for eligibility (self-reported IDU in the past 30 days, <30 years of age, English speaking, and no plans to travel in the next 3 months). Data were gathered using structured interviewer-administered questionnaires and peripheral blood specimens (for HCV testing). Participants were paid \$15 for the baseline interview and testing, and \$40 for results. This analysis is restricted to baseline data from participants enrolled from May 2010 to December 2010 to match dates of data collection from the comparison study.

SFDPH conducted a cross-sectional study using RDS to sample IDU over 18 years of age (NHBS IDU-2) from May 2009 to December 2009. SFDPH was one of a number (25) of national study sites. Methods used have been described in detail previously [10], but in brief, nine socially connected IDU were identified as initial 'seeds'; each given 3 coupons, trained how to recruit others, and how to use the coupons to participate in the study using cash incentives. Seeds were given \$40 to participate in the study and \$10 for each coupon distributed and redeemed by their recruits, for a possible \$70 cash incentive in total. Participants completed an interviewer-administered electronic questionnaire, and HIV and HCV testing. Eligible recruits were then taught how to use RDS coupons to recruit others to participate. This process continued until the sample reached equilibrium on race, gender, and age. Eligibility criteria included self-reported IDU in the last 12 months, self-reported resident of San Francisco,  $\geq 18$  years of age and able to speak English or Spanish. Only participants under age 30 were included in this analysis.

### Variables

We assessed sample characteristics between the two samples including: age, race/ethnicity, gender, education level, recent homelessness, incarceration and overdose history, self-reported HIV status and HCV infection status (anti-HCV results). We examined service utilization by comparing: HIV and HCV testing history (ever), obtaining sterile equipment from a SEP, and having recently visited a health care provider, and participation in drug treatment.

Differences in referent time frames occurred for several measures between the two studies, including recent incarceration, homelessness, accessing an SEP, overdose and health care. The TS study queried participants regarding exposures 3 months prior to the interview, whereas the RDS queried the previous 12 months (Table 1).

### Statistical analysis

Frequency distributions were used to compare sample characteristics from two studies. STATA 11 (StataCorp LP, College Station, Tx) was used to generate point estimates and 95% confidence intervals (CI) from the TS study. For the RDS study, weighted population estimates and 95% CIs were calculated for the RDS sample using RDSAT (v. 5.6, Cornell University, NY) using "Estimate Prevalence" function in to produce stratified proportions for our sub-group of interest (IDU<30), thus disregarding RDS collected referral chains. For this reason, homophily and equilibrium were not assessed within our analysis. The

generated unadjusted and adjusted point estimates and 95% CIs were then examined to compare covariates between the two samples. Due to the independence of the two sub-samples, 95% CIs were compared across each sample to approximate differences in proportions. We considered there to be no statistical difference between proportions where CIs overlapped. We then used a subsample of the RDS study data in STATA to provide unadjusted ratios for reference. A P-value of  $\leq 0.05$  was the pre-determined level to determine significant differences between samples.

### Results

The RDS study sample included 31 participants, the TS had 97. Table 1 shows the comparisons between groups (TS and RDS), who were similar with respect to: age (median was 25.7 and 27 years, respectively); proportion reporting recent incarceration, self-reported HIV positive status, and having ever accessed drug treatment (overlapping 95% CIs). The RDS sample compared to the TS sample was more heterogeneous demographically, having a higher proportion of women, and more Latino and African Americans than the TS sample. A significantly greater proportion of TS participants reported homelessness, but a lower proportion reported having ever been tested for HIV (88.5% vs. 98.6%). Young IDU in the TS sample had a significantly higher prevalence of anti-HCV (58.7%) compared to the RDS sample (15.1%). There were no significant differences in service utilization between each sample, HCV testing, drug treatment utilization, having obtained sterile needles from an SEP and reported visiting a medical provider in the last three months.

### Discussion

Differences in HCV proportion of young IDU who tested HCV seropositive in the study samples were the most striking difference between the two samples of young IDU. We found a significantly higher proportion of anti-HCV positive participants in the TS sample compared to the RDS sample, which suggests a difference in injecting risk behaviors or potentially social mixing in each sample. The RDS method resulted in a sample that was more racially and ethnically diverse and with more women than the TS method. However, neither study was able to identify young Asian IDU. This finding is notable since Asians represent 34.2% of San Francisco's general population [6], but constituted less than 1% IDU study samples [5]. Some of the differences in characteristics between the two samples may be related to factors other than the outside sampling methods, such as inclusion criteria (for instance length of time injecting was past 30 days in the TS sample vs past year on the RDS sample), incentive schedules, and study perception within the community of young IDU in San Francisco.

Examining unadjusted proportions revealed some notable differences: TS recruited a high proportion of white males, which resembles a national trend: a shift in the ethnic and racial make-up of the IDU population has been observed. For example, the number of non-Hispanic Black IDU has declined in cities like New York, Chicago and Baltimore, a slight increase in non-Hispanic Whites who inject heroin in Chicago and Baltimore, and an increase in Latinos in New York [13]. As well, a higher portion of the RDS sample accessed services including: drug treatment, having obtained needles from an SEP, and reported visiting a medical provider in the last three months. This is in contrast to other comparison studies where chain-referral recruiting was found to have reached young IDU with low service utilization [14-16].

Variable	TS (UFO Study)			RDS (SFDPH study)				p-value
	N = 97	Unadjusted %	Unadjusted 95% CI	N = 31	Unadjusted %	Adjusted %	Adjusted 95% CI	
Age (median years)	25.7			27				
<b>Race/Ethnicity</b>								
Asian	0	0	0	N/A	N/A	N/A	N/A	
African American	1	1	0.0 - 3.1	2	6.45	8.4	0.0 - 23.9	0.22
Filipino or Pacific Islander	N/A	N/A	N/A	0	0	0	0	
Latino	1	1	0.0 - 3.1	7	22.6	15.8	3.1 - 37.4	<b>0.1</b>
Native American	1	1	0.0 - 3.1	0	0	0	0	0.2
Caucasian	77	79.4	71.2 - 87.6	19	61.3	57.2	28.1 - 79.3	0.1
Other	8	8.3	2.7 - 13.8	N/A	N/A	N/A	N/A	
Mixed	9	9.3	3.4 - 15.2	3	9.7	18.6	0.0 - 45.2	0.44
White	77	79.4	71.2 - 87.6	19	61.3	57.2	28.1 - 79.3	0.1
Non-White	20	20.6	12.4 - 28.8	12	38.7	42.8	20.8 - 71.5	
<b>Gender</b>								
Male	65	67	57.5 - 76.5	16	51.6	51.1	25.8 - 70.0	0.2
Female	32	33	23.5 - 42.5	15	48.4	48.9	30.2 - 74.3	
Transgender	0	0	0	0	0	0	0	
<b>HCV infection (anti-HCV)</b>								
Negative	38	41.3	31.1 - 51.6	20	74.1	84.9	69 - 94.5	<b>&lt;0.0001</b>
Positive	54	58.7	48.4 - 68.9	7	25.9	15.1	5.5 - 31	
<b>Graduated high school or GED</b>								
No	37	38.1	28.3 - 48	9	29	22.2	9.8 - 40.3	0.08
Yes	60	61.9	52 - 71.7	22	71	77.8	59.9 - 90.2	
<b>Recent incarceration*</b>								
No	67	71.3	62 - 80.6	18	58.1	74.6	54.1 - 89.4	0.74
Yes	27	28.7	19.4 - 38	13	41.9	25.4	10.7 - 45.9	
<b>Recent homelessness*</b>								
No	19	20	11.8 - 28.2	12	38.7	50.5	23 - 68	0.02
Yes	76	80	71.8 - 88.2	19	61.3	49.5	32 - 77	
<b>Ever tested for HIV</b>								
No	11	11.5	5.0 - 18.0	1	3.23	1.4	0.0 - 4.4	<b>&lt;0.0001</b>
Yes	85	88.5	82.1 - 95.0	30	96.7	98.6	95.6 - 100	
<b>Self-report HIV Status</b>								
Negative	74	87.1	79.8 - 94.3	23	74.2	83.1	67.8 - 94.2	0.6
Positive	3	3.5	0.0 - 7.5	1	3.2	3.3	0.0 - 9.5	0.94
Unknown	8	9.4	3.1 - 15.7	7	22.6	13.6	3.8 - 27.8	0.54
<b>Ever tested for HCV</b>								
No	21	22.1	13.6 - 30.6	5	16.1	32.6	0.0 - 71.8	0.58
Yes	74	77.9	69.4 - 86.4	15	48.4	67.4	28.2 - 100	
<b>Ever been to drug tx</b>								
No	32	33.3	23.7 - 42.9	6	19.4	29	5.8 - 55.5	0.76
Yes	64	66.7	57.1 - 76.3	25	80.7	71	44.6 - 94.2	
<b>Obtained needles from needle exchange program*</b>								
No	21	21.7	13.3 - 30	5	16.13	34.6	3.7 - 55.3	0.04
Yes	76	78.4	70.0 - 86.7	26	83.9	65.4	44.8 - 96.3	
<b>Recent Overdose*</b>								
No	95	97.9	95.1 - 100	28	96.6	94.9	89.3 - 100	0.32
Yes	2	2.1	0.0 - 4.9	1	3.4	3.3	0.0 - 10.7	
<b>Recent Health Care*</b>								
No	45	46.4	36.3 - 56.5	7	22.6	34.6	3.7 - 55.3	0.08
Yes	52	53.6	43.5 - 63.7	24	77.4	65.4	44.8 - 96.3	

P-values in Bold indicate no overlap in 95% Confidence Intervals when comparing unadjusted TS point estimates to adjusted RDS point estimates; NA = data not available  
 \* RDS = 12 month "recent" referent period; TS = 3 month "recent" referent period  
 Unadjusted = Unweighted

**Table 1:** Comparison of population characteristics of IDU recruited using TS (UFO Study) and RDS (SFDPH) in San Francisco, California.

There are several limitations to our analysis and the results must be interpreted with caution. First, study samples were small, limiting statistical power and resulting in wide confidence intervals and impacting sample variance. As a result, the findings cannot be generalized. Second, differences in study methodologies including eligibility criteria, instruments, lexicon in the measures, and procedures could affect comparisons and certainly the variance associated with the point estimates. Finally, differences in the time frame of data collection could also have impacted comparability due to unmeasured temporal factors, which would have also influenced the two samples obtained. We note, however, that the time between the studies was small (less than a year) and to our knowledge there were no significant factors or events affecting the “landscape” of young IDU in those time periods. Analytically, RDS data, which involve non-independent sampling, does not allow for interpretation of age-stratified data as “population-based.” However, since the intention of this comparison is to assess differences and similarities between the two samples, rather than population generalizability, we felt that disregarding the ‘chain’ was justified. Finally, we note that this analysis was not intended to analyze risk behaviors in these groups, but rather, to assess the “shape” of this elusive population as sampled by different methods.

It must be acknowledged that the RDS study (NHBS IDU-2) did not specifically target young IDU, and IDU under age 18 were not eligible to participate; this is likely reflected in the low proportion of younger IDU sample (31/521; 5.95%). We did not compare the locale or neighborhoods that the studies targeted, and this could have introduced differences in the two studies as well, as IDU characteristics can vary by neighborhood [17,18].

Most studies comparing RDS to other sampling methods like TS, snowball sampling, or time-location sampling have done so to determine RDS’ generalizability and reduced biases, its ability to reach a racially/ethnically diverse sample, and its ability to reach a higher risk population [16,19,20]. Some researchers have challenged RDS’ reliance on statistical and theoretical assumptions [21], and concerns have also been raised regarding the potential for loss of privacy and confidentiality among RDS sampled participants [22,23]. In a separate analysis of the SFDPH-collected data (NHBS IDU-2), researchers noted that while the IDU population in San Francisco have a strong social network and appear to be amenable to peer-driven research, a rather positive endorsement of RDS, IDU under age 35 represented only 10% of that sample (N=40) [7]. Rudolph et al. found that recruitment coupons, recruitment training, and sampling from neighborhoods with a positive attitude towards drugs and drug users, was positively associated with the success of RDS recruitment [16]. Both Garfein et al. and Rudolph et al. found minor differences in population characteristics [14,16]. And while TS has been assessed to be flexible with its strategies, the “targeted” approach may result in an overlooked groups, and undersampled groups which limit generalizability.

In conclusion, the samples compared here are more similar than not. Since the overall population of young IDU is neither well enumerated nor characterized on a population-level, it is not possible to say whether one of these methods is superior. Indeed, both have strengths and limitations with respect to inference. A true comparison would require using RDS and TS in side-by-side comparison studies with equal amount of payment or incentives and identical, if not shared, field site locations and staff, since all could influence data collection. More research must be done to truly characterize IDU populations as well as at-risk youth and young adults as they are at high risk of blood born infections and drug-related overdose [9,24]; are likely to

experience symptoms of depression [25,26]; and less likely to utilize health and social services [27]. Therefore, optimizing techniques that reach and sample hidden populations, especially young IDU, where interventions are urgently needed to improve these outcomes.

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## Contributors

Authors Dr. Page and Dr. Fisher Raymond designed the studies and wrote the study protocols. Ms. Briceño managed the literature review and wrote the first draft of the manuscript. Ms. Briceño and Ms. Evans undertook the statistical analysis, with additional support from Dr. Morris. All authors contributed to and have approved the final manuscript.

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