Published in final edited form as:

J Subst Abuse Treat. 2016 December ; 71: 48–53. doi:10.1016/j.jsat.2016.08.015.

From long-term injecting to long-term non-injecting heroin and cocaine use: the persistence of changed drug habits

Don C. Des Jarlais¹, Kamyar Arasteh¹, Jonathan Feelemyer¹, Courtney McKnight¹, David M. Barnes¹, Susan Tross², David C. Perlman¹, Aimee N. C. Campbell², Hannah LF Cooper³, and Holly Hagan⁴

¹ Icahn School of Medicine at Mount Sinai, New York, NY

² New York State Psychiatric Institute, Department of Psychiatry, Columbia University Medical Center, New York, NY

³ Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Emory University, Atlanta Georgia

⁴ College of Nursing, New York University, New York NY

Abstract

Objectives—Transitioning from injecting to non-injecting routes of drug administration can provide important individual and community health benefits. We assessed characteristics of persons who had ceased injecting while continuing to use heroin and/or cocaine in New York City.

Methods—We recruited subjects entering Mount Sinai Beth Israel detoxification and methadone maintenance programs between 2011 and 2015. Demographic information, drug use histories, sexual behaviors, and “reverse transitions” from injecting to non-injecting drug use were assessed in structured face-to-face interviews. There were 303 “former injectors,” operationally defined as persons who had injected at some time in their lives, but had not injected in at least the previous 6 months. Serum samples were collected for HIV and HCV testing.

Results—Former injectors were 81% male, 19% female, 17% White, 43% African-American, 38% Latino/a, with a mean age of 50 (SD=9.2), and were currently using heroin and/or cocaine. They had injected drugs for a mean of 14 (SD=12.2) years before ceasing injection, and a mean of 13 (SD=12) years had elapsed since their last injection. HIV prevalence among the sample was 13% and HCV prevalence was 66%. The former injectors reported a wide variety of reasons for ceasing injecting. Half of the group appeared to have reached a point where relapse back to injecting was no longer problematic: they had not injected for three or more years, were not deliberately using specific techniques to avoid relapse to injecting, and were not worried about relapsing to injecting.

Contact Author Information: Don C. Des Jarlais, PhD, Professor of Psychiatry, The Baron Edmond de Rothschild Chemical Dependency Institute, Icahn School of Medicine at Mount Sinai, 39 Broadway 5th Floor Suite 530, New York, NY 10006, 212.256.2548, ddesjarlais@chpnet.org.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conclusions—Former injectors report very-long term behavior change towards reduced individual and societal harm while continuing to use heroin and cocaine. The behavior change appears to be self-sustaining, with full replacement of an injecting route of drug administration by a non-injecting route of administration. Additional research on the process of long-term cessation of injecting should be conducted within a “combined prevention and care” approach to HIV and HCV infection among persons who use drugs.

Keywords

Former-injectors; Relapse; Non-injection drugs use; HIV; Hepatitis C

1. Introduction

The transition from using illicit drugs through non-injecting routes of administration to injecting greatly increases the risk of harmful consequences (Fuller et al., 2002). Injecting greatly increases the likelihood of infection with blood-borne viruses such as HIV and hepatitis C (HCV), the likelihood of other infections such as skin abscesses and endocarditis, the likelihood of developing a substance use disorder, and the likelihood of an overdose (Degenhardt & Hall, 2012; Garfein, Vlahov, Galai, Doherty, & Nelson, 1996; Kerr et al., 2007; Spijkerman, van Ameijden, Mientjes, Coutinho, & van den Hoek, 1996). As injecting drug use is heavily stigmatized, injecting also increases the likelihood that the user will experience severe social discrimination (Ahern, Stuber, & Galea, 2007).

Compared to intranasal administration, injecting typically produces more intense drug effects and is a relatively cost-efficient method of drug administration. The transition from non-injecting to injecting drug use is often considered a permanent change in the preferred route of drug administration. While the person who injects may also use non-injectable drugs (nicotine, alcohol, marijuana), continued use of injectable drugs is likely to be primarily through injecting.

“Reverse transitions” from injecting to non-injecting drug use have been observed in a variety of locations, including New York City (Des Jarlais et al., 2007), New Haven (Schottenfeld, O'Malley, Abdul-Salaam, & O'Connor, 1993), Baltimore (Genberg et al., 2011), Amsterdam (Buster et al., 2009), Brazil (Inciardi et al., 2006), China (Li et al., 2011) and Malaysia (Tejani, Chawarski, Mazlan, & Schottenfeld, 2011). These “former injectors” can maintain heroin/cocaine use for long periods of time—often decades—without relapsing back to injecting (Des Jarlais et al., 2007). They do as well in methadone treatment as persons who inject (Schwartz et al., 2015) and they are less likely to acquire HCV than persons who continue to inject (Des Jarlais et al., 2013).

There is still much that is not known about reverse transitions from injecting to non-injecting drug use, in particular, how some former injectors avoid relapse to injecting over long periods of time. Relapse is considered one of the defining characteristics of substance use disorders. One would expect that persons who have reverse transitioned from injecting to non-injecting drugs would have great difficulties in avoiding relapse back to a route of administration that produces an intense drug effect at a relatively low monetary cost. For example, in a Baltimore study of 936 persons who ceased injecting, three-quarters of them

relapsed back to injecting, the median time before relapse was only 1 year, and both non-injecting use of heroin and of cocaine after ceasing injecting were significantly associated with shorter time to relapse (Shah, Galai, Celentano, Vlahov, & Strathdee, 2006).

In this report we examine various characteristics of a group of 303 former injectors, most of whom have maintained their non-injecting drug use over long periods of time. We specifically examine their reasons for stopping injecting, the length of time since their last injection, whether they are worried about relapsing to injecting, their use of specific mechanisms for avoiding relapse, and their attitudes towards the different highs produced by injecting versus non-injecting drug use. Finally, we consider implications of the findings for reducing drug injecting and for changing drug use behavior in general.

2. Materials and Methods

The findings reported here are derived from data collected from patients/subjects entering the Mount Sinai Beth Israel drug detoxification and methadone maintenance programs in New York City. The methods for this “Risk Factors” study have been previously described in detail (Des Jarlais et al., 1989; Des Jarlais et al., 2009) so only a summary will be presented here. The Mount Sinai Beth Israel detoxification program serves New York City as a whole, with approximately half of the patients residing in Manhattan, one quarter in Brooklyn, one-fifth in the Bronx, and the remainder (about 5%) in other areas. Patients enter the program voluntarily.

Research staff visited the general admission wards of the program in a preset order and examined all intake records of a specific ward to construct lists of all patients admitted within the prior 3 days. All of the patients on the list for the specific ward were then asked to participate in the study. Among patients approached by our interviewers, willingness to participate was more than 95%. After all of the patients admitted to a specific ward in the 3-day period had been asked to participate and interviews had been conducted among those who agreed to participate, the interviewer moved to the next ward. As there was no relationship between assigning patients to wards and the order that the staff rotated through the wards, these procedures would yield an unbiased sample of persons entering the detoxification program.

A structured questionnaire covering demographic characteristics, HIV risk behavior, and drug use history was administered by a trained interviewer to each patient. Most drug use and HIV risk behavior questions referred to the 6 month period prior to the interview. Subjects were asked if they had ever injected illicit drugs, and if yes, their age at first injection and how long it had been since their last injection. “Former injectors” were operationally defined as subjects who 1) reported that they had injected drugs at some point in their lives, 2) reported that they had not injected within the last 6 months, and 3) that they had continued to use injectable drugs (heroin, cocaine or amphetamines) through non-injecting routes of administration (intranasal use and/or smoking and/or oral use). Former injectors were also asked about reasons for stopping injecting, whether they were using specific strategies to avoid relapse, and if yes, to describe those strategies. Multiple responses were permitted for both reasons for ceasing injecting and strategies.

Subjects were also asked to compare the “highs” of cocaine and heroin when used through different routes of administration. They were asked “How do you compare the high of injecting heroin (and/or cocaine) to the high of snorting heroin (and/or cocaine)?”

After completing the interview, each participant was seen by an HIV counselor for pretest counseling for HIV and HCV, along with specimen collection. (It was not possible to collect serum samples from all participants due to problems with collapsed veins.) HIV testing was conducted at the New York City Department of Health laboratory by using a commercial, enzyme-linked, immunosorbent assays (EIA) test with Western blot confirmation (BioRad Genetic Systems HIV-1-2+0 EIA and HIV-1 Western Blot, BioRad Laboratories, Hercules, CA). Samples were tested for HCV antibody with the Ortho HCV enzyme immunoassay (EIA) 3.0 (Ortho-Clinical Diagnostics, Inc., Raritan, NJ). Samples with optical density values of > 8.0 were considered positive, samples with values of 1.0 to 8.0 were confirmed positive with radio-immune blotting assay (RIBA) (Chiron RIBA HCV 3.0 Strip Immunoblot Assay, Novartis Vaccines & Diagnostics, Inc. Emeryville, CA) and samples with values < 1.0 were considered negative.

Serial cross-sectional data have been collected for the project since 1990. We did permit individuals to participate in the study in different years. For the analyses reported here we used only the last interview from the 9 former injectors who participated more than once.

STATA 13 (StataCorp, College Station, TX), was used for analyses and for generating graphs. We utilized the Epanechnikov kernel density estimates for smoothing curves in the graphs.

The study was approved by the Mount Sinai Beth Israel Institutional Review Board.

3. Results

A total of 303 participants were included in the analysis; 63% from the detoxification program and 37% from the methadone maintenance program. Below we describe the participant sample along with the results of the qualitative analysis of injecting patterns, strategies to avoid relapse back to injecting, and how different routes of administration produce different highs.

3.1 Demographics and Drug Use Behavior

Table 1 presents demographic characteristics, current drug use behaviors, HIV and hepatitis C (HCV) serostatus. The subjects were predominantly male and predominantly African-American and Latino/a. They had a mean age of 50 (SD 9.2), and had injected drugs for considerable amounts of time, with a mean of 14 and median of 12 years of injecting. Intranasal heroin was used by a substantial majority (71%) of subjects in the 6 months prior to the interview, though a majority (53%) also reported smoking crack cocaine and a substantial minority (34%) reported using intranasal cocaine. All subjects reported previous episodes of substance use treatment, with 98% having previously received methadone and/or detoxification programs, and 61% having previously received both detoxification and methadone maintenance.

Figure 1 shows the distribution of times since last injection. We represented the distribution of time since last injection in a histogram. The height of each column in the histogram depicts the number of participants corresponding to the years-since-last-injection at the base of that column. In order to also present a continuous depiction of this distribution, we used the Epanechnikov kernel density estimate to connect the column data points. In this technique the data point being evaluated is placed at the center of the kernel and other data points are weighted according to their distance from the point being evaluated, thereby giving greater influence to the data points closer to the center of the kernel.

While the modal time since last injection was within the previous year (15%), substantial proportions reported very long time periods since their last injection: 56% of these former injectors reported a decade or longer since their last injection, 35% reported 20 years or longer since their last injection, and 15% reported 30 years or longer since their last injection. With allowances for recall rounding to the nearest decade by some subjects in their reported time since last injection, the curve is similar to an exponential decay curve.

Table 2 shows a cross-tabulation of last drug injected (only a single drug could be named in response to this question) and the non-injecting drug use reported for the last 6 months by the former injectors (multiple drugs could be mentioned). There is considerable continuity in the use of heroin and cocaine. Of the 227 persons who reported heroin as their last drug injected, 75% of them reported intranasal use of heroin in the 6 months prior to the interview, and of the 26 who reported cocaine as their last drug injected 85% of them reported smoking crack cocaine in the 6 months prior to the interview. Thus, even within a context of poly-drug use, these subjects maintained considerable continuity in the drugs they were using while having made a major change in their route of drug administration.

3.2 Reasons for ceasing injection

Table 3 presents the reasons cited by former injectors for why they stopping injecting. Subjects were permitted to endorse multiple reasons (the percentages thus add to greater than 100%). A considerable variety of reasons were endorsed, and no single reason was endorsed by as many as 20% of the former injectors. Protecting health (avoiding HIV/AIDS endorsed by 12%, afraid of overdose by 15%, other health concerns by 17%) and problems with injecting as a route of administration (don't like needles by 16%, got tired of injecting by 14%, loss of veins by 9%, prefer mellow high of snorting by 5%, difficulties in obtaining injection equipment by 4%) were the two most frequently endorsed major categories of reasons for ceasing to inject. A substantial percentage also cited social and self-image concerns (avoiding stigmatization by 12%, avoiding track marks by 12%, maintaining self-image as a non-injector by 4%) as reasons for ceasing to inject.

3.3 Worry about relapse

Many former drug users report avoiding relapse back to injecting drug use as being a “one day at a time” continuous struggle, and with great concern that they will relapse (Binswanger et al., 2012; Evans, Hahn, Lum, Stein, & Page, 2009; McKay, 1999). We asked these former injectors whether they were “worried that they would relapse back to

injecting?” A very large majority (86%) reported that they were not worried about relapsing back to injecting.

Length of time since last injection was negatively associated with being worried about relapsing to injecting in univariate logistic regression (see Table 4a). Among the 85 former injectors whose last injection was ≤ 36 months prior to the interview, 21 (25%) reported being worried about relapsing, while among the 218 former injectors whose last injection was > 36 months prior to the interview, only 20 (9%) were worried about relapsing back to injecting (chi squared = 12.57, df=1, $p < 0.001$; OR=0.31, 95% CI= 0.15 – 0.61). Worrying about relapse was not significantly associated with any other demographic and drug use variables in Table 1.

3.4 Strategies to avoid relapse

Relapse prevention programs typically teach former drug users a variety of techniques to prevent relapse, including avoiding situations that would cue drug craving, seeking social support, and realizing that a single “lapse” does not have to mean a full relapse back to continued drug use (Dejong, 1994; Marlatt & Donovan, 2005; Witkiewitz & Marlatt, 2004). We asked the former injectors if they were using any specific strategy to avoid relapse, and, if they were, to briefly describe the strategy. A large majority (235/303, 78%) reported that they were not consciously using any specific strategy. Among the 67 former injectors who reported that they were using a specific strategy, 43% reported using self-talk/thinking negative thoughts about injecting, 18% reported avoiding places and people that might lead them back to injecting, 13% reported that they attended meetings, 9% reported that they were using alternative methods of drug administration, and 8% reported aversion to needles.

There was a positive relationship between worrying about relapse and using specific strategies to avoid relapse—former injectors who reported worrying about relapse were more likely to report that they were using specific strategies than former injectors who were not worried about relapse (see Table 4b). Having a specific strategy was not significantly related to any of the demographic or current drug use variables in Table 1 (full data available from the first author).

3.5 Comparisons of “highs” between injecting and intranasal drug use

As noted above, it is generally accepted that injecting a psychoactive drug produces a more intense drug effect than intranasal administration, though there may be considerable individual variation in the differences. We asked these former injectors if injecting heroin gave them a more intense high compared to intranasal use and if injecting cocaine gave them a more intense high compared to intranasal use. (These questions were asked only of the persons who were currently using heroin or cocaine intranasally and had injected that drug in the past.) Modest majorities of the current heroin and cocaine users reported that injecting gave them a more intense high—63% endorsing that injecting heroin gave a more intense high and 52% endorsing that injecting cocaine gave a more intense high. We assessed whether endorsing the greater intensity statements was associated with being worried about relapse (results presented in Tables 5a and 5b). The association between endorsing greater

intensity of injecting and being worried about relapse approached statistical significance for heroin ($p=0.066$) and was significant for cocaine ($p=0.03$).

4. Discussion

Addiction is often defined as a chronic, relapsing condition in which it is very difficult—though not impossible—for individuals to make long-lasting changes in their patterns of drug use. The common image of a former drug user is a person who is attempting to avoid relapse, a person who must be vigilant to avoid people, places, and things that can trigger craving, and is deliberately using multiple evidence-based techniques to avoid relapse.

As shown in Table 3, the former injectors interviewed in this study reported a great number of reasons for ceasing to inject drugs. Ceasing to inject usually was not a goal in itself, but rather was a means to achieve a wide variety of individual goals. From the content of the reasons in Table 3, it would appear that ceasing to inject would probably have been very effective in achieving these goals. For example, a third of the former injectors ceased injecting over 20 years ago, before large-scale syringe exchange programs were implemented in New York City. It is likely that ceasing to inject at that time provided considerable protection against HIV and HCV infection, as well as protection from transmitting to others if they were seropositive. And, as the stigmatization of injecting drug use has clearly continued in New York City, it is likely that ceasing to inject also reduced stigmatization. A recent study from Finland would also suggest that transitioning to non-injecting drug use would reduce the risk of fatal drug overdose. In that study, fatal overdoses among people who injected drugs were three times more likely than among people using the same drugs through other routes of administration (Onyeka et al., 2016).

As a group, the former injectors in this study reported relatively long periods of injecting drug use—a mean of 12 years—followed by long periods since their last injection, with over half reporting 10 years or more since their last injection and over a third reporting 20 years or more since their last injection. There was, however, considerable variation among the former injectors. A subgroup of former injectors appear to be still “in the process” of actively avoiding relapse to injection drug use. They were worried about relapsing, had shorter times since last injection, deliberately used specific strategies to avoid relapse and were likely to recall injecting as providing a more intense high than intranasal drug use. However, this description fits only a modest percentage of these former injectors—only 6/303 (2%) had all four of these characteristics, and 39 (13%) had three of these characteristics.

A second, much larger proportion of these former injectors appear to have reached stability where avoiding relapse to injecting was no longer problematic for them. It had been a long time since their last injection (at least 3 years and with a mean of 19 years), they were not worried about relapsing, they were not consciously using specific strategies to avoid relapse, and only about half of them recalled injecting as providing a more intense high than intranasal use. This description fits 145/303 (48%) of the former injectors in our sample. It would seem that they had fully replaced the habit of injecting drug use with a habit of non-injecting drug use.

Changing drug use behavior in a direction of reduced individual and societal harm and in a way that becomes self-sustaining is a major goal of harm reduction and substance use treatment programs. It is worth considering several aspects of the sustained behavior change exhibited by these former injectors.

In addition to individual goals, former injectors also ceased injecting and avoided relapse in an environment that provided facilitators for doing so. The quality of street heroin and cocaine in New York City has been relatively high for a long time, so that it is economically feasible to maintain a drug habit without having to inject. There are also low threshold, harm reduction-oriented substance use treatment programs in New York City, so that it is possible to receive treatment that provides a respite from the difficulties of street drug use, reduce one's level of drug tolerance, and reduce (or cease) drug use. 98% of the former injectors in this study reported that they had previously received either detoxification or methadone maintenance treatment and 61% reported that they had previously received both detoxification and methadone maintenance treatment. This episodic treatment for substance use problems clearly did not lead to permanent abstinence, but it is likely to have reduced the chances of relapsing to injecting.

These former injectors did not, however, receive any formal treatment services for avoiding relapse to injecting while continuing non-injecting use of heroin and cocaine. Currently, neither drug treatment programs nor syringe exchange programs in New York City support ceasing to inject while continuing to use heroin or cocaine through non-injecting routes of administration as a formal “treatment goal.”

About a sixth of the former injectors gave their reason for injecting as “They don't like needles.” Fear of/dislike for needles persisted during their injecting careers. Further research into fear of/dislike for needles may provide valuable insights for the treatment of persons with substance use disorders who are currently injecting and for programs to prevent initiation into injecting drug use.

4.1 Memories of injecting

Almost half of these former injectors did not recall injecting as producing a “more intense” high than intranasal heroin or cocaine use is a particularly interesting finding deserving of additional research. It may be that experiencing injecting as not producing a more intense high has a strong biological component and is a selective factor for ceasing to inject and for avoiding relapse to injecting. It is also possible that their memories of injecting were evoked during the long time periods since last injection, and that interference in reconsolidation of these memories led to qualitative changes in the memories towards injecting being a less intense experience. Understanding how memories of injecting might change after ceasing to inject—or ceasing to use specific drugs—could provide important insights into avoiding relapse.

4.2 Limitations

The major limitation is that the data come from cross-sectional surveys rather than a longitudinal study. Thus, we do not know how many former injectors relapsed back to injecting, or the factors that led them to relapse. We also do not know how many ceased

injecting and then later ceased using heroin and cocaine. We also do not know when changes from “being in the process” of avoiding relapse changed to reaching a point where “relapse is no longer problematic.”

In the associations between the reasons for ceasing to inject and current (past 6 month) non-injecting drug use, the reason for ceasing to inject would necessarily have preceded current drug use, but considerable caution is needed with respect to drawing causal inferences because of the many other factors that might have operated over the very long time periods involved.

This study also does not permit estimating the number of former injectors in New York City. In a respondent driven sampling (RDS) study conducted in 2004 (Abdul-Quader et al., 2006), current injectors were permitted to recruit current non-injecting heroin and cocaine users and current non-injecting users were permitted to recruit current injectors. The two groups (current injectors and current non-injecting users) were equally likely to recruit members of the other group as they were to recruit members of their own group (RDS homophilies near 1.0). Half of the subjects recruited in that study were non-injecting drug users and half of the non-injecting users reported that they had previously injected heroin and/or cocaine. Thus, it would appear that about a quarter of street heroin and cocaine users in the city are former injectors, though this may be changing due to the new increases in prescription opioid users beginning to inject heroin.

We did ask the former injectors why they had ceased injecting. From the content of the reasons for ceasing to inject (see Table 3), we would expect that the persons who had ceased injecting and had avoided relapse to injecting are likely to have accomplished these goals. We did not, however specifically determine if they had accomplished these goals.

These limitations would need to be addressed in a cohort study, but note that this may require a very long-term study to capture the full experience of avoiding relapse to injecting over decades during which these former injectors avoided relapse back to injecting.

4.3 Implications for promoting long-term reductions in very harmful drug use behaviors

These former injectors did not cease using heroin and cocaine but they did make a long-term change in their drug use behavior that almost certainly reduced important harmful effects of drug use for both themselves and for the community. This sustained change process appears to involve at least three factors:

1. The majority set individual, achievable behavior change goals, with ceasing injection a means to these goals. Ceasing injection was not an externally imposed goal.
2. Abstinence from heroin and cocaine use was not required, though it was not precluded as part of the long-term drug behavior change process. That important behavior change occurred while the former injectors continued to use psychoactive drugs supports the logic of using agonist drug therapies and not requiring abstinence as a precondition for other important behavior changes.

3. They had a safety net of substance use treatment programs that could be utilized when they could no longer manage their non-injecting drug use. Note that all of these former injectors were interviewed on entry into substance use treatment programs, and all reported episodes of previous drug treatment.

4.4 Combined prevention and care for HIV, HCV, and overdose among PWID

Implementing programs that support “reverse transitions” from injecting to non-injecting drug use might be an important part of combined prevention and care for HCV. HCV is much more efficiently transmitted than HIV through sharing of injection equipment and high rates of HCV infection have persisted among injection drug users in many places where HIV has been brought under control.

PWID who reverse transition to non-injecting drug use should greatly reduce their chances of acquiring HIV and/or HCV. PWID who reverse transition after being infected with HIV or HCV should greatly reduce their chances of transmitting HIV or HCV to others. Additionally, HCV infected PWID who reverse transitioned and were successfully treated for HCV would greatly reduce their chances of re-infection with HCV.

Programs to support “reverse transitions” back to non-injecting drug use might be particularly helpful in areas experiencing transitions from non-medical use of opioid analgesics to heroin injecting.

5. Conclusions

The former injectors in this study have made an important change in their drug use behavior that would reduce adverse consequences at both the individual and societal level. For the majority, this change appears to have reached a point where relapsing back to injecting is no longer problematic for them. Understanding how long-term, self-sustaining changes occur in drug use behaviors is a fundamental question in research on problematic drug use. Additional research on former injectors may provide valuable insights into such change processes. We would suggest that research on cessation of injection among persons not ready or able to completely cease drug use be conducted with a framework of combined prevention and care for HIV/HCV among persons who use drugs.

Acknowledgments

We would like to thank the staff at Mount Sinai Beth Israel who collected the data and performed serologic testing for the participants included in the analysis. We would also like to thank all co-authors for their careful revisions and recommendations of the manuscript.

Role of Funding Source

This work was supported through grants R01DA003574, R01DA035707, and P30DA011041 from the US National Institute on Drug Abuse. The funding agency had no role in the design, conduct, data analysis or report preparation for the study.

References

- Abdul-Quader AS, Heckathorn DD, McKnight C, Bramson H, Nemeth C, Sabin K, Des Jarlais DC. Effectiveness of respondent-driven sampling for recruiting drug users in New York City: findings from a pilot study. *Journal of Urban Health*. 2006; 83(3):459–476. [PubMed: 16739048]
- Ahern J, Stuber J, Galea S. Stigma, discrimination and the health of illicit drug users. *Drug and Alcohol Dependence*. 2007; 88(2):188–196. [PubMed: 17118578]
- Binswanger IA, Nowels C, Corsi KF, Glanz J, Long J, Booth RE, Steiner JF. Return to drug use and overdose after release from prison: a qualitative study of risk and protective factors. *Addiction Science & Clinical Practice*. 2012; 7(1):1. [PubMed: 22966407]
- Buster MC, Witteveen E, Prins M, van Ameijden EJ, Schippers G, Krol A. Transitions in drug use in a new generation of problem drug users in Amsterdam: a 6-year follow-up study. *European Addiction Research*. 2009; 15(4):179–187. [PubMed: 19622884]
- Degenhardt L, Hall W. Extent of illicit drug use and dependence, and their contribution to the global burden of disease. *The Lancet*. 2012; 379(9810):55–70.
- Dejong W. Relapse prevention: an emerging technology for promoting long-term drug abstinence. *International Journal of the Addictions*. 1994; 29(6):681–705. [PubMed: 8034380]
- Des Jarlais DC, Arasteh K, Perlis T, Hagan H, Heckathorn DD, McKnight C, Friedman SR. The transition from injection to non-injection drug use: long-term outcomes among heroin and cocaine users in New York City. *Addiction*. 2007; 102(5):778–785. [PubMed: 17506155]
- Des Jarlais DC, Friedman SR, Novick DM, Sotheran JL, Thomas P, Yancovitz SR, Maslansky R. HIV-1 infection among intravenous drug users in Manhattan, New York City, from 1977 through 1987. *JAMA*. 1989; 261(7):1008–1012. [PubMed: 2915408]
- Des Jarlais DC, McKnight C, Arasteh K, Feelemyer J, Perlman DC, Hagan H, Cooper HL. Transitions from injecting to non-injecting drug use: Potential protection against HCV infection. *Journal of Substance Abuse Treatment*. 2013; 46(3):325–3. [PubMed: 24161262]
- Des Jarlais DC, Arasteh K, Hagan H, McKnight CM, Perlman D, Friedman SR. Persistence and change in disparities in hiv infection among injection drug users in New York City after large-scale syringe exchange programs. *American Journal of Public Health*. 2009; 99(S2):S445–451. [PubMed: 19797757]
- Evans JL, Hahn JA, Lum PJ, Stein ES, Page K. Predictors of injection drug use cessation and relapse in a prospective cohort of young injection drug users in San Francisco, CA (UFO Study). *Drug and Alcohol Dependence*. 2009; 101(3):152–157. [PubMed: 19181458]
- Fuller CM, Vlahov D, Ompad DC, Shah N, Arria A, Strathdee SA. High-risk behaviors associated with transition from illicit non-injection to injection drug use among adolescent and young adult drug users: a case-control study. *Drug and Alcohol Dependence*. 2002; 66(2):189–198. [PubMed: 11906806]
- Garfein RS, Vlahov D, Galai N, Doherty MC, Nelson KE. Viral infections in short-term injection drug users: the prevalence of the hepatitis C, hepatitis B, human immunodeficiency, and human T-lymphotropic viruses. *American Journal of Public Health*. 1996; 86(5):655–661. [PubMed: 8629715]
- Genberg BL, Gange SJ, Go VF, Celentano DD, Kirk GD, Mehta SH. Trajectories of injection drug use over 20 years (1988–2008) in Baltimore, Maryland. *American Journal of Epidemiology*. 2011; 173(7):829–836. [PubMed: 21320867]
- Inciardi JA, Surratt HL, Pechansky F, Kessler F, von Diemen L, da Silva EM, Martin SS. Changing patterns of cocaine use and HIV risks in the south of Brazil. *Journal of Psychoactive Drugs*. 2006; 38(3):305–310. [PubMed: 17165373]
- Kerr T, Fairbairn N, Tyndall M, Marsh D, Li K, Montaner J, Wood E. Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. *Drug and Alcohol Dependence*. 2007; 87(1):39–45. [PubMed: 16959438]
- Li, J.; Luo, J.; Des Jarlais, D.; Koram, N.; Li, P.; Liu, H. Role of sexual transmission of HIV among young non-injection and injection opiate users: a respondent driven sampling study.. Paper presented at the American Public Health Association; Washington, DC.. 2011.

- Marlatt, GA.; Donovan, DM. Relapse prevention: maintenance strategies in the treatment of addictive behaviors. Guilford Press; New York: 2005.
- McKay JR. Studies of factors in relapse to alcohol, drug and nicotine use: a critical review of methodologies and findings. *Journal of Studies on Alcohol*. 1999; 60(4):566–576. [PubMed: 10463814]
- Onyeka IN, Basnet S, Beynon CM, Tiihonen J, Föhr J, Kauhanen J. Association between routes of drug administration and all-cause mortality among drug users. *Journal of Substance Use*. 2016; 00(00):1–7.
- Schottenfeld RS, O'Malley S, Abdul-Salaam K, O'Connor PG. Decline in intravenous drug use among treatment-seeking opiate users. *Journal of Substance Abuse Treatment*. 1993; 10(1):5–10. [PubMed: 8450573]
- Schwartz RP, Kelly SM, Gryczynski J, Mitchell SG, O'Grady KE, Jaffe JH. Heroin use, HIV-Risk, and criminal behavior in Baltimore: findings from clinical research. *Journal of Addictive Diseases*. 2015; 34(2-3):151–161. [PubMed: 26079104]
- Shah NG, Galai N, Celentano DD, Vlahov D, Strathdee SA. Longitudinal predictors of injection cessation and subsequent relapse among a cohort of injection drug users in Baltimore, MD, 1988–2000. *Drug and Alcohol Dependence*. 2006; 83(2):147–156. [PubMed: 16364568]
- Spijkerman IJ, van Ameijden EJ, Mientjes GH, Coutinho RA, van den Hoek A. Human immunodeficiency virus infection and other risk factors for skin abscesses and endocarditis among injection drug users. *Journal of Clinical Epidemiology*. 1996; 49(10):1149–1154. [PubMed: 8826995]
- Tejani, E.; Chawarski, M.; Mazlan, M.; Schottenfeld, RS. Temporal changes in initiation of injection use in heroin users in Malaysia 1968 to 2009.. Paper presented at the College on Problems of Drug Dependence; Hollywood, FL.. Jun 18-23. 2011
- Witkiewitz K, Marlatt GA. Relapse prevention for alcohol and drug problems: that was Zen, this is Tao. *American Psychologist*. 2004; 59(4):224. [PubMed: 15149263]

Highlights

- Former PWID reported long term behavior changes, reducing individual and societal harms
- Many former PWID permanently transitioned back to non-injection drug use
- Over 50% of the sample was not worried about relapsing back to injecting drugs
- Multiple reasons for ceasing injection drug use were cited by former PWID
- Ceasing to inject provides considerable protection against HIV and HCV infection

Figure 1.
Distribution of time since last injection (with Epanechnikov kernel density smoothing)

Table 1

Demographics, current drug use characteristics, and HIV and HCV seroprevalence

	Mean	SD
Age	50	9.2
Years injected	12	12.2
	N	%
Total	303	100
Gender		
Female	56	18
Male	246	81
Race/ethnicity		
White	51	17
African American	131	43
Latino/a	115	38
Current (past 6 month) drug use		
Speedball (nasal)	34	11
Heroin (nasal)	214	71
Cocaine (nasal)	103	34
Crack cocaine	162	53
Previous drug treatment experience	303	100
Total with valid test results	258	
HIV+	34	13
HCV+	170	66

Table 2

Current drug use by last drug injected among former injectors

Last drug injected	Current drug use				
	Speedball (nasal) N (%)	Heroin (nasal) N (%)	Heroin (smoked) N (%)	Cocaine N (%)	Crack cocaine N (%)
Speedball (N=47)	9 (19)	33 (70)	1 (2)	20 (43)	23 (49)
Heroin (N=227)	20 (9)	170 (75)	13 (6)	68 (30)	114 (50)
Cocaine (N=26)	4 (15)	10 (38)	2 (8)	13 (50)	22 (85)

Table 3

Reasons reported for stopping injecting among former injectors

Reason reported	N (%)
Total	303 (100)
Health concerns (avoid AIDS, avoid overdose, other health concerns)	131 (44)
Problems with injecting (don't like needles, tired of injecting, loss of veins, problems obtaining injecting equipment)	134 (45)
Social reactions/self-image (stigmatization by others, wanting to preserve self-image as non-injector)	85 (28)
Other reasons	66 (22)

Table 4a

Being “worried about relapsing to injecting” among former injectors

	Worried		OR	95% CI
	Yes N (%)	No N (%)		
Time since last injection				
36 months	21 (25)	64 (75)	1.00	
> 36 months	20 (9)	198 (91)	0.31	0.15 - 0.61

Table 4b

Being “worried about relapsing to injecting” among former injectors

	Worried		OR	95% CI
	Yes N (%)	No N (%)		
Specific strategy to avoid relapse				
Yes	15 (37)	52 (20)	1.00	
No	26 (63)	209 (80)	0.43	0.21 - 0.88

Table 5a

Intensity of the high from heroin injection and “worried about relapsing to injecting” among former injectors

	Worried		OR	95% CI
	Yes N (%)	No N (%)		
More intense high from injection				
No	22 (16)	112 (84)	1.00	
Yes	6 (8)	73 (92)	2.39	0.93 – 6.18

Table 5b

Intensity of the high from cocaine injection and “worried about relapsing to injecting” among former injectors

	Worried			
	Yes N (%)	No N (%)	OR	95% CI
More intense high from injection				
No	4 (8)	45 (92)	1.00	
Yes	13 (24)	41 (76)	3.57	1.08 – 11.82