

# UCSF

## UC San Francisco Previously Published Works

### Title

Injection behaviors among injection drug users in treatment: the role of hepatitis C awareness.

### Permalink

<https://escholarship.org/uc/item/2rn7m5tc>

### Journal

Addictive behaviors, 37(4)

### ISSN

0306-4603

### Authors

Korthuis, P Todd  
Feaster, Daniel J  
Gomez, Zoilyn L  
et al.

### Publication Date

2012-04-01

### DOI

10.1016/j.addbeh.2011.12.001

Peer reviewed



## Short Communication

## Injection behaviors among injection drug users in treatment: The role of hepatitis C awareness ☆☆☆

P. Todd Korthuis <sup>a,\*</sup>, Daniel J. Feaster <sup>b</sup>, Zoilyn L. Gomez <sup>b</sup>, Moupali Das <sup>c,d</sup>, Susan Tross <sup>e</sup>, Katharina Wiest <sup>f</sup>, Antoine Douaihy <sup>g</sup>, Raul N. Mandler <sup>h</sup>, James L. Sorensen <sup>c</sup>, Grant Colfax <sup>d</sup>, Dennis McCarty <sup>a</sup>, Stephanie E. Cohen <sup>d</sup>, Patricia E. Penn <sup>i</sup>, Diane Lape <sup>a</sup>, Lisa R. Metsch <sup>b</sup>

<sup>a</sup> Department of Medicine and Department of Public Health and Preventive Medicine, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Portland, OR 97239, USA

<sup>b</sup> Department of Epidemiology and Public Health, University of Miami Miller School of Medicine, 1425 Northwest 10th Ave, 3rd floor, Miami, FL 33136, USA

<sup>c</sup> University of California, San Francisco, 1001 Potero Ave., San Francisco, CA 94110, USA

<sup>d</sup> San Francisco Department of Public Health, 356 7th St., San Francisco, CA 94103, USA

<sup>e</sup> HIV Center For Clinical and Behavioral Studies, NYS Psychiatric Institute, 1051 Riverside Drive, New York, NY 10032, USA

<sup>f</sup> CODA, 1027 East Burnside St., Portland, OR 97214, USA

<sup>g</sup> University of Pittsburgh School of Medicine, 3811 O'Hara St # 1059, Pittsburgh, PA 15213, USA

<sup>h</sup> National Institute on Drug Abuse, National Institutes of Health, 6001 Executive Blvd., Bethesda, MD 20892, USA

<sup>i</sup> La Frontera Arizona, 504 W. 29th St., Tucson, AZ 85713, USA

## ARTICLE INFO

## Keywords:

Injection drug use  
Hepatitis C  
Syringe/needle sharing  
Alcoholism  
Opioid-related disorders

## ABSTRACT

**Background:** Injection drug use (IDU) is a primary vector for blood-borne infections. Awareness of Hepatitis C virus (HCV) infection status may affect risky injection behaviors. This study determines the prevalence of risky injection practices and examines associations between awareness of positive HCV status and risky injection behaviors.

**Methods:** We surveyed individuals seeking treatment for substance use at 12 community treatment programs as part of a national HIV screening trial conducted within the National Drug Abuse Treatment Clinical Trials Network. Participants reported socio-demographic characteristics, substance use, risk behaviors, and HCV status. We used multivariable logistic regression to test associations between participant characteristics and syringe/needle sharing.

**Results:** The 1281 participants included 244 (19.0%) individuals who reported injecting drugs in the past 6 months and 37.7% of IDUs reported being HCV positive. During the six months preceding baseline assessment, the majority of IDUs reported obtaining sterile syringes from pharmacies (51.6%) or syringe exchange programs (25.0%), but fewer than half of IDUs always used a sterile syringe (46.9%). More than one-third (38.5%) shared syringe/needles with another injector in the past 6 months. Awareness of positive HCV vs. negative/unknown status was associated with increased recent syringe/needle sharing (aOR 2.37, 95% CI 1.15, 4.88) in multivariable analysis.

**Conclusions:** Risky injection behaviors remain prevalent and awareness of HCV infection was associated with increased risky injection behaviors. New approaches are needed to broadly implement HCV prevention interventions for IDUs seeking addiction treatment.

© 2011 Elsevier Ltd. All rights reserved.

☆ Presentations: Preliminary results were presented at the Addiction Health Services Research Conference, Lexington, KY, October, 22–25, 2010.

☆☆ Sources of funding/disclaimer: Cooperative agreements from the National Institute on Drug Abuse supported the design, distribution, collection and analysis of the clinical trial: California–Arizona Node (U10 DA15815), Florida Node Alliance (U10 DA13720), Mid-Atlantic Node (U10 DA13034), New England Node (U10 DA13038), New York Node (U10 DA13046), Ohio Valley Node (U10 DA13732), Oregon/Hawaii Node (U10 DA13036), Appalachian Tri-State Node (U10 DA020036), Southern Consortium Node (U10 DA13727), and Southwest Node (U10 DA15833). Dr. Korthuis' time was supported through a grant from the National Institute on Drug Abuse (K23 DA019809). The contents of the publication are solely the responsibility of the authors and do not necessarily represent the views of the funding agencies or the U.S. government.

\* Corresponding author at: Oregon Health & Science University, 3181 SW Sam Jackson Park Rd., Mail Code L-475, Portland, OR 97239-3098, USA. Tel.: +1 503 494 8044; fax: +1 503 494 0979.

E-mail address: korthuis@ohsu.edu (P.T. Korthuis).

**1. Introduction**

Injection drug use (IDU) is the primary driver for Hepatitis C virus (HCV) transmission, accounting for the majority of chronic HCV infections in the U.S. (Alter, 1999; Armstrong et al., 2006). Across multiple U.S. studies, 35–65% of current IDUs report risky injection behaviors such as syringe/needle sharing (Bailey et al., 2007; Booth, Kwiatkowski, & Stephens, 1998; Centers for Disease Control & Prevention, 2009; Golub et al., 2007).

Knowledge of harboring a transmissible infection such as HCV may influence risky behaviors. Prior studies of the effects of HCV-infection awareness on risky behaviors demonstrate mixed results. In a serosurvey of out-of-treatment IDUs, those who reported awareness of HCV-infection engaged in fewer risky behaviors compared with those who were unaware (Kwiatkowski, Fortuin Corsi, & Booth, 2002). HCV-aware IDUs may also “sero-sort,” or preferentially engage in risky injection behaviors with others they know to be similarly HCV-infected (Burt, Thiede, & Hagan, 2009). Other studies, however, suggest that HCV awareness is insufficient to change injection risk behaviors (Norden et al., 2009). Little is known about the influence of HCV awareness on IDUs engaged in substance use treatment—information that might improve HCV prevention services in addiction treatment settings.

The purpose of this analysis was to 1) assess the prevalence and correlates of drug use practices among patients presenting for addiction treatment and 2) compare risky behaviors in those reporting HCV-infection with those who reported negative or unknown HCV status.

**2. Methods**

*2.1. Design and setting*

The primary study was a National Drug Abuse Treatment Clinical Trials Network (CTN) trial comparing the effectiveness of strategies to increase HIV testing (Metsch et al., in press). Between January and May 2009, the trial randomized 1281 individuals receiving addiction treatment at 12 geographically diverse, community-based addiction treatment programs. After providing informed consent, participants completed an audio computer assisted self interview recording substance use behaviors.

*2.2. Participants*

Participants receiving addiction treatment were eligible for enrollment if they were 1) ≥ 18 years old, 2) reported unknown or negative HIV status, and 3) had not been tested and received results for HIV within the last 12 months. The current analysis was restricted to the 244 participants who reported IDU in the six months preceding the study baseline assessment.

*2.3. Measures*

Participants were asked about injection risk behaviors over the prior six months using items from Project Inspire (Purcell et al., 2004) and the NIDA Risk Behavior Assessment survey (Needle et al., 1995) including source of syringes, needle cleaning practices, how they cleaned their needles, and recent syringe/needle sharing (the main dependent variable). Participants reported injection and non-injection drug use and drinking alcohol to intoxication in the past 6 months (Colfax et al., 2004).

The independent variable was self-reported HCV infection awareness. Patients were asked, “Have you ever been diagnosed with hepatitis C (yes, no, don’t know)?” Because there was no difference in syringe/needle sharing between participants who reported they were HCV-negative and those who did not know their HCV status, we dichotomized this variable as HCV-positive vs. HCV-negative/unknown.

Covariates included age, gender, race/ethnicity, employment, education, court-mandated treatment, opioid replacement treatment, and whether or not the patient had been jailed in the last 6 months.

*2.4. Analysis*

Descriptive statistics characterized participant socio-demographics, and substance use behaviors. We assessed bivariate and multivariable associations between participant characteristics and any syringe/needle sharing using logistic regression. Variables were included in the multivariable logistic regression model if associated with syringe/needle sharing in univariate analyses ( $p < .20$ ), or on the basis of a priori hypotheses. Potential interactions were assessed.

**3. Results**

*3.1. Participant characteristics*

Of 244 recent IDUs, 60.7% were men, 66.0% white, 14.3% Hispanic, and 10.2% Black race/ethnicity, with a mean age of 39.3 (SD = 11.0) years. Twenty percent were employed, 36.2% had attained at least some college education, 30.3% had been recently incarcerated, 20.1% were receiving court-mandated treatment and 46.7% opioid replacement therapy. Ninety-two IDU (37.7%) reported being positive for HCV, 55 (22.5%) HCV-negative, and 97 (39.8%) unknown HCV status. Compared with those who were HCV negative/unaware, HCV positive IDUs were older (45.3 vs. 35.6 years,  $p < .001$ ), more likely to be women (52.2% vs. 31.6%,  $p = .001$ ) or enrolled in opioid replacement

**Table 1**  
Injection risk behaviors, by self-reported hepatitis C (HCV) status.

|  | HCV positive<br>(n = 92) |       | HCV negative/<br>unknown<br>(n = 152) |       | Total<br>(n = 244) |       | p-value |
|--|--------------------------|-------|---------------------------------------|-------|--------------------|-------|---------|
| Any syringe/needle sharing                   | 41                       | 44.6% | 53                                    | 34.9% | 94                 | 38.5% | .131    |
| Frequency of injection                       |                          |       |                                       |       |                    |       | .206    |
| Less than once a month                       | 20                       | 21.7% | 35                                    | 23.2% | 55                 | 22.6% |         |
| 1–3 times a month                            | 16                       | 17.4% | 21                                    | 13.9% | 37                 | 15.2% |         |
| About once a week                            | 11                       | 12.0% | 7                                     | 4.6%  | 18                 | 7.4%  |         |
| More than once a week,<br>but not every day  | 25                       | 27.2% | 44                                    | 29.1% | 69                 | 28.4% |         |
| Every day                                    | 20                       | 21.7% | 44                                    | 29.1% | 64                 | 26.3% |         |
| Where needles were obtained                  |                          |       |                                       |       |                    |       |         |
| Diabetics                                    | 17                       | 18.5% | 34                                    | 22.4% | 51                 | 20.9% | .485    |
| Street                                       | 13                       | 14.1% | 25                                    | 16.4% | 38                 | 15.6% | .629    |
| Multiple sclerosis/hepatitis <sup>a</sup>    | 3                        | 3.3%  | 2                                     | 1.3%  | 5                  | 2.0%  | .295    |
| Pharmacy                                     | 42                       | 45.7% | 84                                    | 55.3% | 126                | 51.6% | .146    |
| Shooting gallery <sup>a</sup>                | 5                        | 5.4%  | 5                                     | 3.3%  | 10                 | 4.1%  | .407    |
| Needle exchange program                      | 33                       | 35.9% | 28                                    | 18.4% | 61                 | 25.0% | .002    |
| Other  | 16                       | 17.4% | 23                                    | 15.1% | 39                 | 16.0% | .625    |
| Needle cleaning habits <sup>a,b</sup>        |                          |       |                                       |       |                    |       | .310    |
| Always use new needles                       | 36                       | 39.6% | 77                                    | 51.3% | 113                | 46.9% |         |
| Always clean my needle<br>before shooting up | 16                       | 17.6% | 19                                    | 12.7% | 35                 | 14.5% |         |
| Always clean my needle<br>after shooting up  | 22                       | 24.4% | 37                                    | 24.7% | 59                 | 24.5% |         |
| Sometimes clean my needle                    | 14                       | 15.4% | 14                                    | 9.3%  | 28                 | 11.6% |         |
| Never clean my needle                        | 3                        | 3.3%  | 3                                     | 2.0%  | 6                  | 2.5%  |         |
| Needle cleaning method <sup>c</sup>          |                          |       |                                       |       |                    |       |         |
| Clean with soap and water                    | 18                       | 34.0% | 31                                    | 43.1% | 49                 | 39.2% | .303    |
| Clean with alcohol                           | 4                        | 7.5%  | 18                                    | 25.0% | 22                 | 17.6% | .011    |
| Clean with bleach                            | 37                       | 69.8% | 34                                    | 47.2% | 71                 | 56.8% | .012    |
| Clean with boiling water                     | 6                        | 11.3% | 13                                    | 18.1% | 19                 | 15.2% | .300    |
| Did not clean needles <sup>a</sup>           | 0                        | 0%    | 1                                     | 1.4%  | 1                  | 0.8%  | .392    |

<sup>a</sup> p-values based on Fisher’s exact test.

<sup>b</sup> Categories are mutually exclusive.

<sup>c</sup> Needle cleaning method was not asked of participants that always used new needles or never cleaned their needles as indicated in needle cleaning habits. Categories are non-mutually exclusive.

**Table 2**  
Multivariable associations with syringe/needle sharing in recent IDUs ( $n = 244$ ).

| Participant characteristics | % Needle sharing | aOR       | 95% CI       |
|-----------------------------|------------------|-----------|--------------|
| Age                         | –                | 0.95      | (0.92, 0.99) |
| Male                        | 31.8%            | 0.52      | (0.28, 0.96) |
| Race/ethnicity              |                  |           |              |
| White                       | 42.9%            | 1.0 (ref) | –            |
| Hispanic                    | 36.0%            | 2.11      | (0.82, 5.43) |
| Black                       | 36.6%            | 2.04      | (0.65, 6.41) |
| Other                       | 47.8%            | 2.06      | (0.75, 5.66) |
| Education (%)               |                  |           |              |
| <High school                | 51.4%            | 1.0 (ref) | –            |
| High school                 | 34.5%            | 0.50      | (0.24, 1.05) |
| ≥Some college               | 32.2%            | 0.47      | (0.22, 0.99) |
| HCV positive                | 44.6%            | 2.37      | (1.15, 4.88) |
| Used street needles         | 57.9%            | 2.66      | (1.18, 5.97) |
| Any opioid                  | 46.3%            | 4.43      | (1.44, 13.7) |
| Marijuana                   | 47.9%            | 2.10      | (1.09, 4.03) |
| IDU crack                   | 65.0%            | 3.19      | (1.07, 9.49) |

aOR = adjusted odds ratio; CI = confidence interval; HCV = Hepatitis C virus; IDU = Injection Drug Use.

programs (68.5% vs. 33.6%,  $p < .001$ ) and less likely to be recently incarcerated (21.7% vs. 35.5%,  $p = .023$ ).

The most commonly used substances were injected opioids (71.17%), drinking alcohol to intoxication (70.9%), non-injection opioids (66.4%), marijuana (48.8%), crack cocaine (45.1%), and cocaine (30.7%). The majority of IDUs (81.1%) injected more than one substance at a time. HCV positive IDUs were less likely to drink alcohol to intoxication (57.6% vs. 78.9%,  $p < .001$ ) but more likely to inject heroin (68.5% vs. 55.3%,  $p = .041$ ) compared with HCV negative/unaware.

### 3.2. Injection risk behaviors

More than one third (38.5%) of IDUs reported syringe/needles sharing in the past 6 months (Table 1). IDUs obtained needles mostly from pharmacies, syringe exchange programs, and diabetic supplies. Less than half always used a clean needle. Among IDUs who cleaned their needles, cleaning with bleach was the most common method, but many used more ineffective sterilization methods including soap and water. More HCV-positive IDUs reported recent syringe/needle sharing compared with those with HCV negative/unknown status (44.6% vs. 38.5%,  $p = .131$ ), though this was not statistically significant. There was no difference in recent syringe/needle sharing between those who reported being HCV negative vs. unknown status (36.4% vs. 34.0%,  $p = .771$ ). HCV positive IDUs more frequently obtained needles from a syringe exchange program and used bleach if they cleaned needles.

In adjusted analysis (Table 2), recent syringe/needle sharing was more likely among those who reported they were HCV-positive compared with those who were HCV negative/unaware (aOR 2.37 [95% CI 1.15, 4.88]), and among IDUs obtaining needles from the street, using any opioids, marijuana, or injected crack cocaine; sharing was less likely among males and participants with some college education.

## 4. Discussion

Risky injection practices persist among IDUs, with rates in the current study consistent with those of other recent studies (Booth et al., 2011; Centers for Disease Control & Prevention, 2009) and may partially explain persistently high HCV incidence among IDUs (Mehta et al., 2011). In a survey of IDUs in 23 U.S. cities from 2005 to 2006, 31.8% of IDUs reported sharing needles (Centers for Disease Control & Prevention, 2009). Among IDUs enrolling in a behavioral intervention trial (2-session HIV/HCV counseling vs. therapeutic alliance vs. treatment as usual) at residential detoxification centers from 2004

to 2006, 61% reported sharing needles, works, or drug solution (Booth et al., 2011). More widespread adoption of interventions demonstrated to reduce risky injection practices, and development of new, more effective interventions, are urgently needed for patients enrolling in community-based treatment programs.

The majority of IDUs in the present study obtained needles from safe sources, including pharmacies and syringe exchange programs, as corroborated in surveys of IDUs in other U.S. cities with policies that increase availability of sterile needles and syringes (Golub et al., 2005; Khoshnood, Blankenship, Pollack, Roan, & Altice, 2000) – policies that decrease HIV transmission and likely decrease HCV transmission, as well (Des Jarlais et al., 1996; Des Jarlais et al., 2000). Despite this, fewer than half of IDUs reported always using a clean needle or consistently cleaning needles, indicating that needle re-use and lack of needle cleaning are common. Even among the minority of IDUs reporting consistent needle cleaning, sterilization techniques other than use of bleach were frequently employed, suggesting that renewed efforts are needed to promote harm reduction techniques among IDUs. Interventions that promote needle cleaning such as peer-based (Hawkins, Latkin, Mandel, & Oziemkowska, 1999; Rietmeijer et al., 1996), pharmacy-based (Romanelli, Smith, & Pomeroy, 2000), and provider-based (Carlson, Wang, Siegal, & Falck, 1998) interventions, continue to be relevant for IDUs engaged in community-based treatment. At the same time, renewed efforts to increase availability of clean syringe/needles are urgently needed to decrease HCV transmission.

Participants who reported they were HCV positive differed in several important behaviors compared with their counterparts. HCV positive IDUs more frequently exhibited harm reduction behaviors such as obtaining needles from a syringe exchange program, cleaning needles with bleach, and avoiding drinking alcohol to intoxication, suggesting that awareness of HCV status may confer increased adoption of some protective behaviors. HCV positive IDUs, however, were also more likely to inject heroin and, in multivariable analysis, to share needles.

The observed association between HCV-awareness and increased needle/syringe sharing may reflect a complex cluster of characteristics among HCV-aware IDUs in this cross-sectional study. Our data support that HCV awareness is likely a marker for IDUs with greater addiction severity (e.g., increased heroin injection and methadone maintenance among HCV-aware), addiction duration (older age among HCV-aware), and increased opportunities for HCV testing (e.g., increased needle exchange program use among HCV-aware, many of which offer HCV testing).

This finding contrasts with a sero-survey of street-recruited IDUs in Denver from 1998 to 1999, where those with a previous HCV positive test reported less receptive syringe/needle sharing, sharing of drug paraphernalia, and safer injecting practices compared with those with unknown status who tested HCV-positive during the study (Kwiatkowski et al., 2002). It is possible that in populations where higher proportions of IDUs are aware they are HCV-positive, IDUs may adopt more of a fatalistic attitude toward risky injection practices. Indeed, a recent synthesis of qualitative studies of HCV risk among IDUs identified risk ubiquity as a common theme, supporting a perception of HCV as “a risk accepted rather than avoided” (Rhodes, Singer, Bourgois, Friedman, & Strathdee, 2005). This is consistent with findings from a multicenter study of Swedish IDUs, in which 74% of those HCV-aware shared needles compared with 68% of those with unknown status (Norden et al., 2009).

The current study confirms the importance of certain demographic and drug use characteristics previously associated with syringe/needle sharing including younger age, female gender, lower educational attainment, and use of opiates, and crack cocaine. While greater addiction severity is associated with riskier injection behaviors, the current study is among the first to identify an association between marijuana use and risky injection behaviors. Marijuana use in IDUs

may be a marker of risk-taking personality or chronically decreased motivation to protect oneself, as hypothesized to explain similar findings in a study of Russian IDUs (Walley et al., 2008). Further research is required to assess the nature of this association.

This study has limitations. First, our study population was recruited from individuals seeking or actively engaged in treatment in community-based treatment programs. Findings may not be generalizable to IDUs in other settings. Second, HCV status was assessed by self-report and likely underestimates the actual prevalence of HCV. However, one's belief about one's HCV status is conceptually more closely related to injection behaviors than biologically confirmed HCV status. Third, we were unable to assess sero-sorting in the current study, so increased sharing among HCV may have been with other known HCV-positive IDU, as was observed in one prior study (Burt et al., 2009). Finally, the current study's cross-sectional design limits our ability to infer causality. The observed multivariable association between knowledge of HCV status and syringe/needle sharing may reflect overall greater drug use severity among those who become HCV-infected rather than a causal pathway toward increased risky behaviors. Regardless, the association highlights the role of HCV awareness as a marker for IDUs in particular need of harm reduction interventions.

## 5. Conclusions

This study highlights the need for broadly implemented HCV prevention interventions for all IDUs seeking addiction treatment, and suggests such interventions might particularly decrease transmission behaviors by those aware of their HCV infection and prevent HCV infection in those HCV-negative/unaware. Research which prospectively studies the effect of HCV testing and notification on risk behavior could help further clarify the association between HCV awareness and risk behaviors. Interventions that could improve services for IDUs include those that explicitly and repeatedly educate IDUs about safer injection practices and the treatability of HCV, and those that integrate HCV testing and treatment with addiction treatment services. As HCV screening and treatment options advance, community based treatment programs have a greater opportunity to play a central role in reducing HCV transmission and engaging HCV-infected IDUs in treatment.

## Role of funding source

This work was supported by the National Institute on Drug Abuse which supported the design, distribution, collection and analysis of the clinical trial. The final version of the manuscript was reviewed and approved by the NIDA Clinical Trials Network publications committee.

## Contributors

Author Korthuis assisted with data collection, statistical analysis, and wrote the first draft, revisions and final version of the manuscript. Author Feaster assisted with study design, led the statistical analysis, and assisted with revising the manuscript. Author Gomez assisted with statistical analysis and revising of the manuscript. All other authors contributed to study design, interpretation of data and revisions of the manuscript. All authors approved the final manuscript.

## Conflict of interest

No authors have conflicts of interest.

## References

- Alter, M. J. (1999). Hepatitis C virus infection in the United States. *Journal of Hepatology*, 31(Suppl. 1), 88–91.
- Armstrong, G. L., Wasley, A., Simard, E. P., McQuillan, G. M., Kuhnert, W. L., & Alter, M. J. (2006). The prevalence of hepatitis C virus infection in the United States, 1999 through 2002. *Annals of Internal Medicine*, 144(10), 705–714.
- Bailey, S. L., Ouellet, L. J., Mackesy-Amiti, M. E., Golub, E. T., Hagan, H., Hudson, S. M., et al. (2007). Perceived risk, peer influences, and injection partner type predict receptive syringe sharing among young adult injection drug users in five U.S. cities. *Drug and Alcohol Dependence*, 91(Suppl. 1), S18–S29.
- Booth, R. E., Campbell, B. K., Mikulich-Gilbertson, S. K., Tillotson, C. J., Choi, D., Robinson, J., et al. (2011). Reducing HIV-related risk behaviors among injection drug users in residential detoxification. *AIDS and Behavior*, 15(1), 30–44.
- Booth, R. E., Kwiatkowski, C. F., & Stephens, R. C. (1998). Effectiveness of HIV/AIDS interventions on drug use and needle risk behaviors for out-of-treatment injection drug users. [1]. *Journal of Psychoactive Drugs*, 30(3), 269–278.
- Burt, R. D., Thiede, H., & Hagan, H. (2009). Serosorting for hepatitis C status in the sharing of injection equipment among Seattle area injection drug users. *Drug and Alcohol Dependence*, 105(3), 215–220.
- Carlson, R. G., Wang, J., Siegal, H. A., & Falck, R. S. (1998). A preliminary evaluation of a modified needle-cleaning intervention using bleach among injection drug users. *AIDS Education and Prevention*, 10(6), 523–532.
- Centers for Disease Control and Prevention (2009). HIV-associated behaviors among injecting-drug users—23 cities, United States, May 2005–February 2006. *MMWR. Morbidity and Mortality Weekly Report*, 58(13), 329–332.
- Colfax, G., Vittinghoff, E., Husnik, M. J., McKirnan, D., Buchbinder, S., Koblin, B., et al. (2004). Substance use and sexual risk: a participant- and episode-level analysis among a cohort of men who have sex with men. *American Journal of Epidemiology*, 159(10), 1002–1012.
- Des Jarlais, D. C., Marmor, M., Paone, D., Titus, S., Shi, Q., Perlis, T., et al. (1996). HIV incidence among injecting drug users in New York City syringe-exchange programmes. [2]. *Lancet*, 348(9033), 987–991.
- Des Jarlais, C., Perlis, T., Friedman, S. R., Chapman, T., Kwok, J., Rockwell, R., et al. (2000). Behavioral risk reduction in a declining HIV epidemic: injection drug users in New York City, 1990–1997. [2]. *American Journal of Public Health*, 90(7), 1112–1116.
- Golub, E. T., Bareta, J. C., Mehta, S. H., McCall, L. D., Vlahov, D., & Strathdee, S. A. (2005). Correlates of unsafe syringe acquisition and disposal among injection drug users in Baltimore, Maryland. *Substance Use & Misuse*, 40(12), 1751–1764.
- Golub, E. T., Strathdee, S. A., Bailey, S. L., Hagan, H., Latka, M. H., Hudson, S. M., et al. (2007). Distributive syringe sharing among young adult injection drug users in five U.S. cities. *Drug and Alcohol Dependence*, 91(Suppl. 1), S30–S38.
- Hawkins, W. E., Latkin, C., Mandel, W., & Oziemkowska, M. (1999). Do actions speak louder than words? Perceived peer influences on needle sharing and cleaning in a sample of injection drug users. *AIDS Education and Prevention*, 11(2), 122–131.
- Khoshnood, K., Blankenship, K. M., Pollack, H. A., Roan, C. T., & Altice, F. L. (2000). Syringe source, use, and discard among injection-drug users in New Haven, Connecticut. *AIDS & Public Policy Journal*, 15(3–4), 88–94.
- Kwiatkowski, C. F., Fortuin Corsi, K., & Booth, R. E. (2002). The association between knowledge of hepatitis C virus status and risk behaviors in injection drug users. *Addiction*, 97(10), 1289–1294.
- Mehta, S. H., Astemborski, J., Kirk, G. D., Strathdee, S. A., Nelson, K. E., Vlahov, D., et al. (2011). Changes in blood-borne infection risk among injection drug users. *Journal of Infectious Diseases*, 203(5), 587–594.
- Metsch, L. R., Feaster, D. J., Gooden, L., Matheson, T., Mandler, R. N., Haynes, L., et al., in press. Implementing rapid HIV testing with or without risk-reduction counseling in drug treatment centers: results of a randomized trial. *American Journal of Public Health*.
- Needle, R., Fisher, D. G., Weatherby, N., Chitwood, D., Brown, B., Cesari, H., et al. (1995). Reliability of self-reported HIV risk behaviors of drug users. *Psychology of Addictive Behaviors*, 9(4), 242–250.
- Norden, L., Saxon, L., Kaberg, M., Kall, K., Franck, J., & Lidman, C. (2009). Knowledge of status and assessment of personal health consequences with hepatitis C are not enough to change risk behaviour among injecting drug users in Stockholm County, Sweden. *Scandinavian Journal of Infectious Diseases*, 41(10), 727–734.
- Purcell, D. W., Metsch, L. R., Latka, M., Santibanez, S., Gomez, C. A., Eldred, L., et al. (2004). Interventions for seropositive injectors—research and evaluation: an integrated behavioral intervention with HIV-positive injection drug users to address medical care, adherence, and risk reduction. *Journal of Acquired Immune Deficiency Syndromes*, 37(Suppl. 2), S110–S118.
- Rhodes, T., Singer, M., Bourgois, P., Friedman, S. R., & Strathdee, S. A. (2005). The social structural production of HIV risk among injecting drug users. *Social Science & Medicine*, 61(5), 1026–1044.
- Rietmeijer, C. A., Kane, M. S., Simons, P. Z., Corby, N. H., Wolitski, R. J., Higgins, D. L., et al. (1996). Increasing the use of bleach and condoms among injecting drug users in Denver: outcomes of a targeted, community-level HIV prevention program. *AIDS*, 10(3), 291–298.
- Romanelli, F., Smith, K. M., & Pomeroy, C. (2000). Reducing the transmission of HIV-1: needle bleaching as a means of disinfection. *Journal of the American Pharmaceutical Association*, 40(6), 812–817.
- Walley, A. Y., Krupitsky, E. M., Cheng, D. M., Raj, A., Edwards, E. M., Briden, C., et al. (2008). Implications of cannabis use and heavy alcohol use on HIV drug risk behaviors in Russian heroin users. *AIDS and Behavior*, 12(4), 662–669.