

**HIV RISK BEHAVIOURS, PERCEIVED SEVERITY OF DRUG USE PROBLEMS, AND
PRIOR TREATMENT EXPERIENCE IN A SAMPLE OF YOUNG HEROIN INJECTORS
IN DAR ES SALAAM, TANZANIA**

**John Atkinson¹, Sheryl McCurdy¹, Mark Williams²,
Jessie Mbwambo^{3,4}, Gad Kilonzo⁴**

¹Center for Health Promotion and Prevention Research
University of Texas School of Public Health Houston, TX

²Department of Health Policy and Management
Robert Stempel College of Public Health and Social Work
Florida International University Miami, Florida.

³Department of Psychiatry and Mental Health Muhimbili National Hospital

⁴Muhimbili University of Health and Allied Sciences Dar es Salaam, Tanzania

ABSTRACT

Interviews were conducted with 203 male and 95 female heroin injectors aged 17 to 25 in Dar es Salaam, Tanzania. Nearly one-quarter of participants reported injecting with needles used by someone else. Few reported cleaning needles with bleach. Multiple sexual partnerships, unprotected sex, and trading sex for money were especially present among women, the majority (55%) of whom was HIV seropositive. Self reports suggest the presence of heroin dependence among users. While most participants expressed a desire to quit their use, only 14 (5%) had been in treatment. There appears to be a large unmet need for heroin use treatment. These findings need to be considered in light of a potential forthcoming wave of heroin injection in sub-Saharan Africa.

KEY WORDS: HIV, injection drug use, Africa, heroin, drug dependence treatment

INTRODUCTION

Young injectors, under the age of 30, are at greater risk of HIV infection than older IDUs. Studies conducted in the United States and Canada show young injectors are more likely to share needles, drug paraphernalia, and inject in groups more often than older injectors (Fennema, van Ameijden, van den Hoek, &

Coutinho, 1997; Montgomery, Hyde, Derosa, Rohrbach, Ennett, Harvey et al., 2002; Morse, Morse, Burchfiel, & Zeanah, 1998; Fuller, Vlahov, Latkin, Ompad, Celentano, & Strathdee, 2003; De, Cox, Boivin, Platt, & Jolly, 2007). The studies also found young injectors are more likely to be sexually active, have more sex partners, have sex more frequently and trade sex for money (Montgomery et al., 2002;

Fuller et al., 2003; Bacon, Lum, Hahn, Evans, Davidson, Moss et al., 2006; Gyarmathy & Neaigus, 2009; Rondinelli, Ouellet, Strathdee, Latka, Hudson, Hagan et al., 2009). While the reasons young IDUs are more likely to engage in some risk behaviors than older injectors are far from clear, they may stem from their youth and lack of experience. Young IDUs, new to injection drug use, are unlikely to be knowledgeable about needle-sharing risks or possess the skills needed to negotiate and practice safer injecting behaviours. Young injectors also lack the economic resources to provide a stable living environment, which may cause them to spend large amounts of time on the streets. Spending large amounts of time on the streets increases young IDUs' chances of interacting with others engaging in risky needle use and sexual behaviours, including older adults more likely to be infected with HIV (Fuller et al., 2003; Gyarmathy et al., 2009).

Until recently, injection drug use was considered to be rare in sub-Saharan Africa; however studies suggest it is becoming more common (Ross, McCurdy, Kilonzo, Williams, & Leshabari, 2008; Parry, Dewing, Peterson, Carney, Needle, Kroeger et al., 2009). Studies of injectors in sub-Saharan Africa have shown rates of HIV risk behaviours among IDUs are high (Williams, McCurdy, Atkinson, Kilonzo, Leshabari, & Ross, 2007; Parry, Peterson, Carney, Dewing, & Needle, 2008), as are rates of HIV infection (Williams, McCurdy, Bowen, Kilonzo, Atkinson, Ross et al., 2009). Newer high-risk injection practices, such as the use of "flashblood," have also emerged. This practice consists of injecting blood drawn from a previous user (McCurdy, Ross, Williams, Kilonzo, & Leshabari, 2010). However, little research on injection drug use in sub-Saharan Africa extends beyond basic epidemiological studies. While these are important and necessary studies, it is also important to ascertain the problems IDUs associate with their drug use, their desire for help, and their past treatment experiences. Studies conducted in the West have found many IDUs believe drug use causes severe problems in their lives and desire to stop using drugs, but that desire does not lead

to entry into treatment programs or cessation of drug use on their own (Siegal, Falck, Wang, & Carlson, 2002; Wechsberg, Zule, Riehm, Luseno, & Lam, 2007).

A large proportion of drug users in sub-Saharan Africa may be 25 years of age or younger. This preliminary study presents results from a survey of risk behaviors, perceived problems of use, and treatment in a sample of. Unlike almost all other studies of IDUs in sub-Saharan Africa, data for this study are from a sample of heroin injectors aged 17 to 25.

METHODS

Procedures

Data for the study were collected between November 2009 and March 2010 in Dar es Salaam, Tanzania. Participants were recruited using aspects of targeted sampling, modified snowball sampling, and respondent driven sampling (Watters & Biernacki, 1989; Cunningham-Williams, Cottler, Compton, Desmond, Wechsberg, Zule et al., 1999; Heckathorn, Semaan, Broadhead, & Hughes, 2002; Sadler, Lee, Lim, & Fullerton, 2010). To begin sampling, six young IDUs eligible for the study were interviewed and asked to recruit others like themselves. Individuals referred to the study matching study criteria were interviewed and asked to refer others. Participants were paid a small fee (3,000 Tanzanian shillings, about \$1.50) for each person referred and interviewed. Referrals continued until the desired study size was reached. Participants were compensated (5,000 shillings, about \$3.35) for their time and travel expenses for completing an interview.

Eligibility for the study was assessed by responses to a brief questionnaire. To be eligible for the study, individuals had to: (1) be 16 to 25 years of age (16 and 17 year olds no longer living at home and considered emancipated in Tanzania were eligible); (2) have injected heroin at least once in the seven days before screening; (3) be able to show evidence of recent track marking; and (4) be willing to be tested for HIV infection. Eligible individuals

were given complete information about the study and asked to give informed consent. If consent was obtained, respondents were interviewed by a trained research assistant. Interviews were conducted in a small rented office located in a neighborhood near the city center. The interview took 90 to 120 minutes.

All procedures and data collection forms were reviewed and approved by university committees for the protection of human subjects in Tanzania and the United States. In addition, procedures and forms were reviewed by the Tanzanian National Institute for Medical Research and the Tanzania Commission for Science and Technology.

Measures

Data were collected using a computer assisted, face-to-face survey. Measures were derived from surveys previously used with drug injectors in Dar es Salaam and the United States (Williams et al., 2007; Williams et al., 2009; Williams, Ross, Atkinson, Bowen, Klov-dahl, & Timpson, 2006). The same or similar measures to those used in this study produce reliable and valid data when used with drug users in non-institutional settings (Needle, Fisher, Weatherby, Brown, Cesari, Chitwood et al., 1995; Dowling-Guyer, Johnson, Fisher, Needle, Watters, Andersen et al., 1994; Darke, 1998).

The sociodemographic characteristics of participants which were measured included gender, age, religious preference (Muslim, Christian), education (years of schooling), self-perceive homelessness, self-perceived sexual orientation (heterosexual, bisexual, homosexual), and marital status (single, married or living with a partner of the opposite sex, living with a partner of the same sex). Participants' economic circumstances were assessed by income and the number of days worked in the 30 days before they were interviewed.

Injection drug use was measured by asking participants how often they had injected in the previous 30 days and whether they had injected with needles previously used by someone else and the number of times they had used bleach to clean a needle. Participants were also

asked the number of times they had injected flashblood in the previous seven days. Sexual behaviors in the last 30 days were assessed by asking participants how many times they had engaged in oral, anal, and vaginal sex. The total number of sex partners (of any type) was ascertained. Sexually active participants were asked how many times a condom was used. Participants were deemed to have consistently used condoms if the number of times used condoms equaled the number of times had sex. Sexual risk was also measured by asking participants how many times in the previous 30 days they had traded sex for money and sex for drugs.

HIV status was established using the Capillus (Trinity Biotech, Bray, Ireland) and the Determine (Abbot Japan Co. Ltd, Tokyo, Japan) tests. Quality control was performed by the African Medical Research and Education Foundation reference laboratory in Dar es Salaam.

Problems related to participants' drug use were assessed by asking them to respond "no" or "yes" to the following questions. "Do you neglect other pleasures or interests in favor of using heroin?" "Are you interested in quitting drug use?" "Do you have a strong desire or sense of compulsion to use heroin?" "Do you find it difficult or impossible to control your use of heroin?" "Do you experience withdrawal symptoms after going without heroin for a while?" "Do you use heroin to relieve or avoid withdrawal symptoms?" "Do you notice that you required more heroin to achieve the same physical or mental effects?" "Do you experience psychological or physical harm from heroin?"

Participants were also asked, "Do you want to stop using drugs?" "Have you ever tried to quit using drugs on your own?" Those stating they had tried to quit were then asked, "How long were you able to quit using drugs?" Responses were recorded in weeks. Additionally, participants were asked, "Have you ever been in drug treatment?" Those responding "yes" were then asked what kind of treatment they had been in. Lastly, participants were asked if they knew what methadone treatment and buprenorphine treatment were.

Analyses

Differences in these variables by gender were assessed with independent-samples *t*-tests (with equal variances assumed) and chi-square tests as appropriate. The level of significance was $p < .05$, 2-tailed.

RESULTS

Sample Characteristics

A total of 298 interviews were available for analysis. The sample consisted of 203 males (68%) and 95 females (32%). In accordance with eligibility criteria, participants' ages ranged from 17 to 25 with a mean age of 23.2 ($sd = 2.0$). Participants had a mean of 6.3 years of schooling ($sd = 2.6$). A total of 203 participants (68%) were Muslim and 95 (32%) were Christian. Participants had worked an average of 15.9 ($sd = 14.4$) days in the 30 days prior to their interview and had a mean income in that time of 235,823.05 shillings (approximately \$160) ($sd = 122,615.50$, approximately \$80). There were 109 participants (37%) who considered themselves homeless. All males and 94 females (99%) described themselves as heterosexual. One female (1%) described herself as bisexual. Of the males, 194 (96%) were single and 9 (4%) were married or living with a partner of the opposite sex. Of the females, 81 (85%) were single and 14 (15%) were married or living with a partner of the opposite sex ($\chi^2 = 9.65$; $df = 1$; $p < .002$).

Injection Behaviors

Participants had injected heroin on average 88.4 ($sd = 18.9$) times in the prior 30 days. Sixty-six participants (22%) had injected in the previous 30 days with needles which had been used by someone else. Three males (1%) and no females had used bleach at least once to clean their needles in the previous 30 days. One male (< 1%) and one female (1%) had injected with flashblood in the previous seven days. These injection behaviours did not differ by gender.

Sexual Behaviors

Overall, 106 males (52%) and 88 females (93%) had at least one sex partner in the previous 30 days ($\chi^2 = 46.53$; $df = 1$; $p < .001$). Sexually active males had a mean of 1.7 partners ($SD = 1.0$) and females had a mean of 54.6 ($sd = 73.6$) partners ($t = -7.40$; $df = 192$; $p < .001$). Forty-three males (21%) had more than one partner compared to 77 females (81%) ($\chi^2 = 96.44$; $df = 1$; $p < .001$). Four males (2%) and 17 females (18%) had engaged in anal sex in the 30 days preceding their interview ($\chi^2 = 25.05$; $df = 1$; $p < .001$). Eight males (4%) and 10 females (11%) had engaged in oral sex ($\chi^2 = 4.95$; $df = 1$; $p = .03$). One-hundred-five males (52%) and 88 females (93%) reported vaginal sex ($\chi^2 = 47.46$; $df = 1$; $p < .001$). Males reported having vaginal sex an average of 2.9 times ($sd = 2.0$) while females had sex 87.5 times on average ($SD = 95.1$) ($t = -9.11$; $df = 191$; $p < .001$).

Four males (2%) had traded sex for money in the previous 30 days compared to 78 (82%) of the females ($\chi^2 = 208.36$; $df = 1$; $p < .001$). Three males (2%) had traded sex for drugs as had 16 females (17%) ($\chi^2 = 25.59$; $df = 1$; $p < .001$). No males and 1 female (10%) stated they had used condoms every time they had oral sex in the previous 30 days, with data missing for one male. Gender differences for condom use for oral and anal sex were not significant. No males and 5 females (29%) had consistently used condoms for anal sex. Sixteen males (15%) and 24 females (27%) stated they had used condoms every time they had vaginal sex ($\chi^2 = 4.09$; $df = 1$; $p = .04$), with data missing for one male.

HIV Serostatus

Forty-one males (20%) and 52 females (55%) had previously been tested for HIV ($\chi^2 = 35.96$; $df = 1$; $p < .001$). Of these, 36 males (88%) and 50 females (96%) had gotten their test results, a nonsignificant difference. Of these, one male (3%) and five females (10%) reported they had tested positive; reported serostatus did not vary by gender. For this study, HIV test results were available for 198 males (98%) and 91 females (96%). Among these participants, 24 males

(12%) and 50 females (55%) were seropositive ($\chi^2 = 60.02$; $df = 1$; $p < .001$).

Drug Use Severity and Treatment

Table 1 shows the number and percentage of respondents answering in the affirmative to the substance use severity and treatment questions. As seen, substantial majorities endorsed the severity items and had a desire to quit.

With regard to ceasing drug use, approximately one-fifth of participants had tried to quit on their own. Of the 63 participants who had tried to quit using drugs on their own, the mean length of time they had been able to quit was 22.2 (SD = 36.5) weeks. Of the 14 participants who had been in drug treatment, five had been in day treatment; four had been in inpatient rehabilitation; three had been in outpatient treatment; and two had been in inpatient detoxification. One male stated knowing what methadone and buprenorphine treatment were. Responses to the severity and treatment items did not vary by gender.

DISCUSSION

Injection heroin use is an increasingly important risk factor for the transmission of HIV

in sub-Saharan Africa. In addition to being a risk factor for HIV transmission, use may result in lost opportunity and decreased productivity. Users are engaging in an illegal activity and may turn to other illegal activities such as exchanging sex for money or drugs which carry their own risk of transmission. These risks may be especially prevalent among young injectors. Users are often those who are marginalized in terms of resources or status, and those who are HIV seropositive may perceive additional stigmatization. Cases resulting from injection drug use may present increasing demands on treatment systems. However, it may also be early enough in the injection epidemic that effective plans can be developed and implemented. Part of this process will be understanding users' perception of the severity of their drug use problems as well as their treatment needs and experiences.

Results of our surveys conducted with young injectors show marginalization as reflected in the mean levels of education and income and in the proportion of participants who thought of themselves as homeless. As noted, such marginalization may lead to exposure to riskier drug use and sexual settings. On average, participants were injecting three times a day, one-fifth had injected with previously

Table 1: Addiction Severity and Treatment Experience (N = 298)

	N	%
Do you neglect other pleasures or interests in favor of using heroin?	280	94%
Are you interested in quitting drug use?	295	99%
Do you have a strong desire or sense of compulsion to use heroin?	291	98%
Do you find it difficult or impossible to control your use of heroin?	261	90%
Do you experience withdrawal symptoms after going without heroin for a while?	286	96%
Do you use heroin to relieve or avoid withdrawal symptoms?	289	97%
Do you notice that you required more heroin to achieve the same physical or mental effects?	283	95%
Do you experience psychological or physical harm from heroin?	289	97%
Do you want help to stop using drugs?	296	99%
Have you ever tried to quit using drugs on your own?	63	21%
Have you ever been in drug treatment?	14	5%
Do you know what methadone treatment is?	1	< 1%
Do you know what buprenorphine treatment is?	1	< 1%

used needles, and few had used bleach to clean their needles. However, in this sample, injectors were not engaged in using flashblood. Among women, an interaction of injection drug use and sex was present. The majority of women in this sample was sexually active, had multiple partners, and had recently traded sex for money. Most had engaged in unprotected sex. The majority of women were HIV seropositive, and many infected participants do not appear to have been previously aware of their serostatus. Also of note is the percentage of males who were sexually inactive. While drug use may often decrease inhibitions, heroin use may also suppress libido.

The findings of this study regarding gender and sexual behavior support those of Williams et al. (2007). A greater proportion of women than men in Dar es Salaam were then found to be sexually active. Women were more likely to have traded sex for money or drugs, engaged in vaginal sex more frequently and had more partners. As in the current study, many males were sexually inactive. Unlike the present study, men were more likely to have injected with used needles.

Responses to the severity and treatment items show participants perceived serious problems related to their drug use. These were manifested in terms of a compulsion to use heroin and an inability to control usage. Participants reported needing to use more of the drug to maintain effects and withdrawal when usage stopped. Participants experienced physical and psychological problems resulting from use and expressed a desire for help in quitting. Despite this desire, relatively few had tried to quit on their own. Among those trying, the average participant was able to quit for about four months. Fewer participants had actually been in treatment. Results also showed a lack of knowledge of pharmacological treatments. While not diagnostic, the findings suggest a level of problems indicative of substance dependence.

There were limitations to this study. The sample of injection drug users was not selected randomly. However, this is true of most studies involving drug users as random sampling

techniques often do not apply to such a hidden population. The study was conducted in one city among a sample of young adult heroin users which was predominantly heterosexual, and thus the generalizability of the findings to other settings and individuals may be limited. Measures of drug use and sexual behaviors were based on self-report. However, as noted, such measures have been found to be valid and reliable in previous studies of drug users (Needle, Fisher, Weatherby, Brown, Cesari, Chitwood et al., 1995; Dowling-Guyer, Johnson, Fisher, Needle, Watters, Andersen et al., 1994; Darke, 1998). Due to the maximum age requirement for eligibility, it is suspected that some participants over the age of 25 may have lied about their age. Measures of severity consisted of dichotomous response items and were not intended as clinical assessments. With regard to participants who reported previous treatment, it was not known whether these individuals completed treatment or how long they were able to maintain abstinence following treatment. Barriers to treatment were not assessed. Nor did this study consider psychological factors such as depression which may affect risk taking. While participants were shown to be marginalized, stigma related to drug use, sexual behavior, or HIV infection was not assessed.

A strength of this study is that it was conducted with a sample of young injectors. Responses to the study items indicate that participants perceived serious problems related to their use, want to quit drug use, and desire help in quitting. Results show the need for increasing injectors' awareness of the risks related to needle use and sex. As detailed by McCurdy et al., government sponsored harm reduction efforts include outreach; information and communication; risk reduction counseling; HIV testing and counseling; and detoxification programs. In 2005, over 200,000 previously untested individuals sought VCT services. Over 100,000 HIV patients were enrolled in care and treatment sites at the end of 2006 (McCurdy et al., 2010).

There may be limits to a harm reduction approach with injectors. As noted, there are

currently no needle exchange or opiate substitution programs in Tanzania, and awareness of methadone and buprenorphine was virtually nonexistent. Heroin injection is an illegal activity. Providers may not want to appear to be condoning such behaviour. Efforts to address this concern and pilot studies to assess the feasibility and effectiveness of such programs might be called for. The fact that participants expressed a desire to quit drug use suggests users may be amenable to abstinence based interventions. On the other hand, with regard to sexual behaviors, it may be unrealistic to expect sexual abstinence among young adults. Harm reduction measures which emphasize consistent condom use and monogamous relationships may be appropriate (Hilton, Thompson, Moore-Dempsey, & Janzen, 2001). Bowser and colleagues found a California based harm reduction focused drug treatment program for female users engaged in trading to be an effective preparation for achieving full recovery (Bowser, Ryan, Smith, & Lockett, 2008).

Given these efforts to reduce risks and to improve testing and treatment services, considerations to address remain. Stigma is associated with drug use, HIV, and prostitution which may prevent injectors from seeking services. While services are becoming more available, users may not have knowledge of, or access, to them. Some users may not believe in the efficacy of treatment. Services will be limited by the resources and technologies available to providers. There may be a need for collaboration among the different actors involved in HIV and drug use prevention and treatment. For example, Rothman et al. considered the "co-location" of HIV prevention and primary care services within drug treatment programs in New York State (Rothman, Rudnick, Slifer, Agins, Heiner, & Birkhead, 2007). The extent to which programs such as those described by Bowser and Rothman can be feasible in other settings needs to be evaluated.

Several additional avenues for future research and intervention are suggested. These include administering diagnostic measures of drug use severity in order to address the question of how self-reported responses would

compare to diagnostic criteria of substance abuse or dependence. Studies should include the use of theoretical models of behaviour such as Fishbein's Integrative Model to examine injectors' intention to enter treatment and subsequent treatment behavior as a function of attitudes, self-efficacy, and norms regarding entering treatment (Fishbein, 2008). Such a model could be applied to other relevant behaviors such as safe injection practices and condom use. A stages of change model may be useful in distinguishing those who have actually entered treatment from those who have not. Injectors should be asked about barriers they face to entering treatment or trying to quit on their own. The present findings will be enhanced by analysis of qualitative interviews conducted in the summer of 2010.

Many infected participants were not aware of their positive serostatus before being tested for this study or, alternatively, may not have wanted to disclose their status. Efforts appear warranted to help women transition from survival sex. Several males reported no recent sexual activity. While this may be desirable from a disease transmission perspective, it may be less so from a quality of life one since, as noted, heroin has been associated with decreased libido. Efforts to address these issues may be warranted. Injectors may be aided by interventions such as twelve-step programs and other group therapy approaches as presented by Flores (1997).

Injection drug use appears poised to challenge the healthcare and drug treatment services of sub-Saharan Africa. At the same time, an understanding of injectors' risk behaviors, their perceptions about drug use and drug treatment would make a contribution to developing workable public health solutions to the emerging epidemic.

ACKNOWLEDGEMENT

This study was supported by grant #1R21DA025478-01 from the National Institute on Drug Abuse, S. McCurdy Principal Investigator.

REFERENCES

- Bacon, O., Lum, P., Hahn, J., Evans, J., Davidson, P., Moss et al. (2006). Commercial sex work and risk of HIV infection among young drug-injecting men who have sex with men in San Francisco. *Sexually Transmitted Diseases*, 33, 228-234.
- Bowser, B.P., Ryan, L., Smith, C.D., & Lockett, G. (2008). Outreach-based drug treatment for sex trading women: The Cal-Pep risk reduction demonstration project. *The International Journal of Drug Policy*, 19, 492-495.
- Cunningham-Williams, R.M., Cottler, L.B., Compton, W.M., Desmond, D., Wechsberg, W., Zule, W. et al. (1999). Reaching and enrolling drug users for HIV prevention: A multi-site analysis. *Drug and Alcohol Dependence*, 54, 1-10.
- Darke, S. (1998). Self-report among injecting drug users: A review. *Drug and Alcohol Dependence*, 51: 253-263.
- De, P., Cox, J., Boivin, J., Platt, R., & Jolly, M. (2007). The importance of social network in their association to drug equipment sharing among injection drug users: A review. *Addiction*, 102, 2730-1739.
- Dowling-Guyer, S., Johnson, M., Fisher, D., Needle, R., Watters, J., Andersen, M. et al. (1994). Reliability of drug users' self-reported HIV risk behaviors and validity of self-reported recent drug use. *Assessment*, 1, 383-392.
- Fennema, J., van Ameijden, E., van den Hoek, A., & Coutinho, R. (1997). Young and recent-onset injecting drug users are at higher risk for HIV. *Addiction*, 92, 1457-1465.
- Fishbein, M. (2008). A reasoned approach to health promotion. *Medical Decision Making*, 28, 834-844.
- Flores, P.J. (1997). Group psychotherapy with addicted populations; An integration of twelve-step and psychodynamic theory (2nd ed.) Binghamton, NY: The Haworth Press, Inc.
- Fuller, C., Vlahov, D., Latkin, C., Ompad, D., Celentano, D., & Strathdee, S. (2003). Social circumstances of initiation of injection drug use and early shooting gallery attendance: Implications for HIV intervention among adolescent and young adult injection drug users. *Journal of Acquire Immune Deficiency Syndromes*, 32, 86-93.
- Gyarmathy, V. & Neaigus, A. (2009). The relationship of sexual dyad and personal network characteristics and individual attributes to unprotected sex among young injection drug users. *AIDS and Behavior*, 13, 196-206.
- Heckathorn, D., Semaan, S., Broadhead, R., & Hughes, J. (2002). Extensions of respondent-driven sampling: A new approach to the study of injection drug users aged 18-25. *AIDS and Behavior*, 6, 55-67.
- Hilton, B.A., Thompson, R., Moore-Dempsey, L., & Janzen, R.G. (2001). Harm reduction theories and strategies for control of human immunodeficiency virus: a review of the literature. *Journal of Advanced Nursing*, 33(3), 357-370.
- McCurdy, S.A., Ross, M.W., Williams, M.L, Kilonzo, G.P. & Leshabari, M.T. (2010). Flashblood: blood sharing among female injecting drug users in Tanzania. *Addiction*, 105, 1062-1070.
- Montgomery, S., Hyde, J., De Rosa, C., Rohrbach, L., Ennett, S., Harvey, S. et al. (2002). Gender differences in HIV risk behaviors among young injectors and their social network members. *American Journal of Drug and Alcohol Abuse*, 28, 453-475.
- Morse, E., Morse, P., Burchfiel, K., & Zeanah, P. (1998). Behavioral factors affecting HIV prevention for adolescent and young adult IDUs. *Journal of the Association of Nurses in AIDS Care*, 9, 77-90.
- Needle, R., Fisher, D., Weatherby, N., Brown, B., Cesari, H., Chitwood, D. et al. (1995). The reliability of self-reported HIV risk behaviors of drug users. *Psychology of Addictive Behaviors*, 9, 242-250.
- Parry, C., Peterson, P., Carney, T., Dewing, S., & Needle, R. (2008). Rapid assessment of drug use and sexual HIV risk patterns

- among vulnerable drug-using populations in Cape Town, Durban, and Pretoria, South Africa. *Journal of Social Aspects of HIV/AIDS*, 5(3), 113-119.
- Parry, C.D.H., Dewing, S., Peterson, P., Carney, T., Needle, R., Kroeger et al. (2009). Rapid assessment of HIV risk behavior in drug using sex workers in three cities in South Africa. *AIDS Behavior*, 13: 849-859.
- Rondinelli, A., Ouellet, L., Strathdee, S., Latka, M., Hudson, S., Hagan, H. et al. (2009). Young adult injection drug users in the United States continue to practice risk behaviors. *Drug and Alcohol Dependence*, 104, 167-174.
- Ross, M.W., McCurdy S.A., Kilonzo, G.P., Williams, M.L., & Leshabari, M.T. (2008). Drug use careers and blood-borne pathogen risk behavior in male and female Tanzanian heroin injectors. *American Journal of Tropical Medicine and Hygiene*, 79(3): 338-343.
- Rothman, J.R., Rudnick, D., Slifer, M., Agins, B., Heiner, K., & Birkhead, G. (2007). Co-located substance use treatment and HIV prevention and primary care services, New York State, 1990-2002: A model for effective service delivery to a high-risk population. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 84(2), 226- 241.
- Sadler G., Lee H., Lim R., & Fullerton J. (2010). Recruitment of hard-to-reach population subgroups via adaptations of the snowball sampling strategy. *Nursing & Health Issues*, 12, 369-374.
- Siegal, H.A., Falck, R.S., Wang, J., & Carlson, R.G. (2002). Predictors of drug abuse treatment among crack-cocaine smokers. *Drug and Alcohol Dependence*, 68, 159-166.
- Watters, J. & Biernacki, P. (1989). Targeted sampling: Options for the study of hidden populations. *Social Problems*, 36: 416-430.
- Wechsberg, W., Zule, W.A., Riehman, K.S., Luseno, W.K., & Lam, W.K. K. (2007). African-American crack abusers and drug treatment initiation: barriers and effects of a pretreatment intervention. *Substance Abuse Treatment Prevention, and Policy*, 2, 10. Retrieved July 29, 2010 from <http://www.substanceabusepolicy.com/content/2/1/10>. (Archived by WebCite® at <http://www.webcitation.org/5uAXK1a6S>).
- Williams, M., Ross, M., Atkinson, J., Bowen, A., Klovdahl, A., & Timpson S. (2006). An investigation of concurrent sex partnering in two samples having large numbers of sex partners. *International Journal of STD and AIDS*, 17, 309-314.
- Williams, M., McCurdy, S., Atkinson, J., Kilonzo, G., Leshabari, M., & Ross, M. (2007). Differences in HIV risk behaviors by gender in a sample of Tanzanian injection drug users. *AIDS and Behavior*, 11, 137-144.
- Williams, M.L., McCurdy, S.A., Bowen, A.M., Kilonzo, G.P, Atkinson, J.S, Ross, M.W. et al. (2009). HIV seroprevalence in a sample of Tanzanian intravenous drug users. *AIDS Education and Prevention*, 21(5), 474-483.

