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## Short communication

## Evidence of injection drug use in Kisumu, Kenya: Implications for HIV prevention



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## ABSTRACT

**Background:** Injection drug use is increasingly contributing to the HIV epidemic across sub-Saharan Africa. This paper provides the first descriptive analysis of injection drug use in western Kenya, where HIV prevalence is already highest in the nation at 15.1%.

**Methods:** We draw on quantitative data from a study of injection drug use in Kisumu, Kenya. We generated descriptive statistics on socio-demographics, sexual characteristics, and drug-related behaviors. Logistic regression models were adjusted for sex to identify correlates of self-reported HIV positive status.

**Results:** Of 151 participants, mean age was 28.8 years, 84% ( $n = 127$ ) were male, and overall self-reported HIV prevalence reached 19.4%. Women had greater than four times the odds of being HIV positive relative to men (Odds Ratio [OR] 4.5, CI: 1.7, 11.8,  $p = .003$ ). Controlling for sex, ever experiencing STI symptoms (Adjusted Odds ratio [AOR] 4.6, 95% CI 1.7, 12.0,  $p = .002$ ) and sharing needles or syringes due to lack of access (AOR 3.6, 95% CI 1.2, 10.5,  $p = .02$ ) were significantly associated with HIV positive status. Lower education (AOR 2.3, 95% CI 0.9, 5.6,  $p = .08$ ), trading sex for drugs (AOR 2.8, 95% CI 0.9, 8.8,  $p = .08$ ), being injected by a peddler (AOR 2.9, 95% CI 1.0, 8.5,  $p = .05$ ), and injecting heroin (AOR 2.3, 95% CI 1.0, 5.7,  $p = .06$ ), were marginally associated with HIV.

**Conclusions:** This exploratory study identified patterns of unsafe drug injection and concurrent sexual risk in western Kenya, yet few resources are currently available to address addiction or injection-related harm. Expanded research, surveillance, and gender sensitive programming are needed.

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## 1. Introduction

Injection drug use is increasingly contributing to the HIV epidemic across sub-Saharan Africa, in part due to trafficking networks that are introducing drugs into new regions (UNODC, 2014; Asher et al., 2013). East Africa is an important node in global drug trafficking routes moving heroin from Asia to Europe (UNODC, 2013). In Kenya, heroin injection has been documented along the coast and in Nairobi for decades largely due to “spillover” of drugs in

transit (Beckerleg et al., 2005). Recent evidence suggests that other drugs (e.g., cocaine, methamphetamine) may also transit through Kenya (UNODC, 2014), and as regional trafficking patterns shift into smaller, less organized distribution units (Dimova, 2014), new patterns of drug use, including drug injection, are diffusing into new sociocultural contexts.

National HIV prevalence in Kenya is 5.6%, but prevalence among people who inject drugs in Nairobi and coastal Kenya is estimated at 18.3% overall, reaching 44% among women who inject (National AIDS Control Council, 2014). The growing recognition of injection as a public health crisis prompted Kenya to launch its first needle and syringe exchange programs (NSP) in Nairobi and the coast in 2013, and methadone provision in select locations is currently underway.

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Although mapping exercises suggest that injection drug use also occurs in regions outside of Kenya's historic epicenters of injection (NASCO, 2013b), harm reduction programs in outlying areas are lacking. Epidemiologic data are urgently needed to enhance our understanding of drug use trends and inform ongoing efforts to develop interventions in emergent drug markets.

This paper presents evidence of injection drug use in the Nyanza region of western Kenya, where HIV prevalence is already highest in the nation at 15.1% (NASCO, 2013a). Kisumu (population ~400,000) is the region's main city. Characterized by rapid urbanization, socioeconomic inequalities, and a young, mobile population, Kisumu offers a case study for the diffusion of injection drug use into new areas of sub-Saharan Africa where drug use has yet to be addressed in HIV prevention efforts. With the efficiency of HIV transmission via injection being six-times higher than via heterosexual sex, injection-driven epidemics often spread more rapidly than epidemics driven by sexual transmission alone (UNODC, 2005). Given the elevated HIV prevalence throughout the region, this suggests that even a modest presence of injection drug use could compromise HIV prevention efforts in western Kenya. We provide a descriptive analysis of injection drug use in Kisumu and associations with self-reported HIV positive status in order to inform HIV prevention programming.

## 2. Methods

This study analyzes quantitative survey data from a study of injection drug use in Kisumu. The project was conducted in partnership with a non-governmental organization that recently launched services for people who inject drugs based on a peer educator model (i.e., current or former drug users recruit people from their networks for education and services). Researchers worked with peer educators to locate participants using targeted sampling in Kisumu neighborhoods where injection was known to occur. Snowball sampling was then used to reach deeper into injectors' social networks. Researchers privately screened individuals based on eligibility criteria: being at least 18 years old, reporting injecting drugs in the past month, and having physical evidence of injection. All eligible men and women agreed to provide written consent for surveys conducted in English, Kiswahili, or Dholuo (the local language), based on preference.

From October, 2013 to July, 2014, injectors participated in a 1 h survey covering socio-demographics, sexual behaviors, alcohol and drug use, and injection risk behaviors. Surveys were interview-administered on laptops using REDCap software. Participants were reimbursed 300 Kenyan shillings (~U.S. \$4). Protocols were approved by the Ethics Committees of the University of California, San Diego, the Kenya Medical Research Institute, and The Ohio State University.

Descriptive statistics, stratified by sex, examine socio-demographic, sexual, and drug-related variables using *t* tests or Wilcoxon rank sum tests for continuous outcomes and Pearson  $\chi^2$  or Fisher's exact tests for binary outcomes. Logistic regression identified correlates of self-reported HIV positive status: univariate results revealed significant sex disparities, prompting us to run separate logistic regression models for each independent variable, adjusted for sex. Associations at  $p < .05$  were considered statistically significant, but because our research is exploratory, we also discuss associations of marginal significance ( $p < .10$ ).

## 3. Results

Our sample was young (mean age 28.8; sd 6.2) and 84% male (Table 1). Sex differences emerged in socio-demographic factors, as women were significantly younger ( $p = .02$ ), less likely to have a high school education ( $p = .04$ ), and less likely to have a steady partner ( $p = .003$ ), yet more likely to have children living at home ( $p < .001$ ).

Sexual risk was prevalent, as more than half (61.6%) reported unprotected sex within the past month and women were more likely than men to do so (79.2% vs. 58.3%,  $p = .05$ ). Women were also more likely to have ever traded sex for money (66.7% vs. 35.4%,  $p = .004$ ) or drugs (37.5% vs. 9.5%,  $p < .001$ ). STI testing among our sample was uncommon (34.4%).

Mobility and migration was gendered, as less than half of all men (48.8%) reported living their entire lives in Nyanza, while nearly all women (95.8%) remained within Nyanza for their entire life. This has important implications for exposure to drugs

elsewhere in Kenya: about half of all men (52.8%) first injected in Kisumu, and reported injecting for an average of 6.6 years. In comparison, women had marginally fewer years of injecting (4.5 years,  $p = .06$ ) and were significantly more likely to initiate injecting locally (82.6%,  $p = .008$ ), suggesting that injection may be a new phenomenon in Kisumu for women.

Recent alcohol use (92.4%), "bhang" (marijuana; 67.6%), and non-medical use of prescription drugs (21.2%) were prevalent. Participants reported injecting cocaine (76.2%) and two types of heroin: 16.6% injected "brown sugar," a coarse brown powder with poor water solubility, while 12.6% injected "white crest," a highly soluble white powder. Women were marginally more likely to inject "brown sugar" (29.2% vs. 14.2%,  $p = .07$ ). In addition to prevalent needle/syringe and paraphernalia sharing behaviors, 12.6% reported sharing blood in a practice sometimes called "flashing" (i.e., a person who is high shares their blood with another user who injects it). More than one quarter (26.7%) reported being injected by people selling drugs (locally called "peddlers").

In total, 93.3% ( $n = 140$ ) were ever tested for HIV, 139 of whom reported a result. Self-reported HIV prevalence was higher among women than men (43.5% vs. 14.7%,  $p < .001$ ). Table 2 presents correlates of self-reported HIV status. In bivariate analysis, women had more than four times the odds of being HIV positive compared to men (Odds Ratio [OR] 4.5, CI: 1.7, 11.8,  $p = .003$ ). Controlling for sex, ever experiencing STI symptoms (Adjusted Odds ratio [AOR] 4.6, 95% CI 1.7, 12.0,  $p = .002$ ) and sharing needles or syringes due to lack of access (AOR 3.6, 95% CI 1.2, 10.5,  $p = .02$ ) were significantly associated with HIV positive status. Lower education (AOR 2.3, 95% CI 0.9, 5.6,  $p = .08$ ), trading sex for drugs (AOR 2.8, 95% CI 0.9, 8.8,  $p = .08$ ), being injected by a peddler (AOR 2.9, 95% CI 1.0, 8.5,  $p = .05$ ), and injecting heroin (AOR 2.3, 95% CI 1.0, 5.7,  $p = .06$ ) were marginally associated with HIV.

## 4. Discussion

To our knowledge, our study provides the first descriptive analysis of injection drug use and HIV prevalence in western Kenya. Our work has implications for the HIV epidemic in Kisumu and other emergent drug markets in sub-Saharan Africa that may be experiencing outbreaks of injection drug use.

While data are limited, a recent review suggests that HIV prevalence among injectors in sub-Saharan Africa ranges from 5% to 50% and may be 2–4 fold higher among women compared to men (Asher et al., 2013). In our study, overall self-reported HIV prevalence (19.4%) exceeds regional estimates and women had four times the odds of reporting HIV infection compared to men (43.5% prevalence among women vs. 14.7% among men). Our results reflect global research revealing how women's socioeconomic disadvantage, family responsibilities, and overlapping sexual and drug-related risk heighten their vulnerability to HIV (El-Bassel et al., 2014; Lambdin et al., 2013; McCurdy et al., 2010; Cleland et al., 2007), indicating the need for tailored HIV prevention and treatment programs (UNODC, n.d.).

Two factors remained significantly associated with self-reported HIV after adjusting for sex: STI symptomatology and sharing needles and syringes due to lack of access, suggesting overlap in sexual and drug-related risk that could potentiate the HIV epidemic. In the sexually driven, generalized HIV epidemic in western Kenya – as in much of sub-Saharan Africa – we should anticipate that HIV could be introduced into injection networks via risky sexual behavior; once HIV enters newly establishing drug networks, its transmission could be amplified by the efficiency of risky injection practices (Strathdee et al., 2010). Our findings underscore the importance of addressing sexual risk in interventions for people

**Table 1**  
Characteristics of people who inject drugs in Kisumu, Kenya, by sex:  $n = 151$ .

Factors	Women, $n = 24$ (%)	Men, $n = 127$ (%)	Total, $n = 151$ (%)	$p$
<b>Socio-demographics</b>				
Age (Mean, sd – standard deviation)	26.1 (5.5)	29.3 (6.2)	28.8 (6.2)	.02
≥High school education	9(37.5)	76(59.8)	85(56.3)	.04
Currently enough \$ to meet needs	3(12.5)	15(11.8)	18(11.9)	.92
Spouse/steady partner	9(37.5)	88(69.3)	97(64.2)	.003
Children <18 at home	19(79.2)	51(40.2)	70(46.4)	<.001
<b>Sexual behaviors</b>				
Unprotected sex past 30 days	19(79.2)	74(58.3)	93(61.6)	.05
Sex while high past 30 days	16(66.7)	85(66.9)	101(66.9)	.98
Ever traded sex for money	16(66.7)	45(35.4)	61(40.4)	.004
Ever traded sex for drugs	9(37.5)	12(9.5)	21(13.9)	<.001
Ever any STI symptoms	10(41.7)	77(60.6)	87(57.6)	.09
Ever tested for STI	12(50.0)	40(31.5)	52(34.4)	.08
<b>Indicators of mobility</b>				
Born in Kisumu	21(87.5)	86(67.7)	107(70.9)	.05
Lived in Nyanza region entire life	23(95.8)	62(48.8)	85(56.3)	<.001
First injected in Kisumu	19(82.6)	67(52.8)	86(57.3)	.008
<b>Past 30 day drug and alcohol use</b>				
Any alcohol use	21(95.5)	113(91.9)	134(92.4)	.56
Bhang (marijuana)	15(62.5)	87(68.5)	102(67.6)	.57
Prescription pills	2(8.3)	30(23.6)	32(21.2)	.11
Cocaine injection	16(66.7)	99(78.0)	115(76.2)	.23
Brown Sugar (heroin) injection	7(29.2)	18(14.2)	25(16.6)	.07
White Crest (heroin) injection	1(4.2)	18(14.2)	19(12.6)	.31
<b>Injection risk behaviors</b>				
Years injecting (mean, sd)	4.5 (4.1)	6.6 (5.0)	6.2 (4.9)	.06
Know how to inject	16(66.7)	104(81.9)	120(79.5)	.09
Ever injected by peddler	4(25.0)	28(26.9)	32(26.7)	.99
Shared needles/syringes, past 30 days	9(37.5)	58(48.7)	67(46.9)	.31
Shared cooker, past 30 days	21(87.5)	94(74.0)	115(76.2)	.20
Ever “Flushed” (injected blood)	2(8.3)	17(13.4)	19(12.6)	.74
<b>HIV testing</b>				
Ever had an HIV test	23(95.8)	117(92.9)	140(93.3)	.59
HIV+ (self-report) <sup>a</sup>	10(43.5)	17(14.7)	27(19.4)	.001

<sup>a</sup>  $n = 139$  (23 women, 116 men) who reported an HIV test result.

who inject drugs, including STI treatment (Brodish et al., 2011; Avants et al., 2004; Kurth et al., 2011).

Findings related to needle and syringe sharing suggest that improving access to sterile equipment is imperative to avert an injection drug-related HIV epidemic in this region. In Kisumu, high dead space syringes (i.e., syringes with detachable needles) are commonly used, which may increase HIV transmissibility due to the space inside the syringe that can harbor blood (Zule et al., 2013). Our data reinforce the need for NSP initiatives that promote low dead space syringes and are scaled to empower users to access new syringes for each injection.

Several additional factors were marginally associated ( $p < .10$ ) with self-reported HIV in our adjusted models, including lower education and trading sex for drugs, which are markers of structural vulnerability (Rhodes et al., 2012) and further emphasize overlapping sexual and drug-related risk (Strathdee et al., 2010). Moreover, we identified unique drug-related HIV risks, which our preliminary ethnographic work also suggests are important features of an emerging injection risk environment (unpublished data). More than one quarter reported being injected by peddlers, which is alarming considering that injection assistance is a known risk factor for HIV (O’Connell et al., 2005). Users cannot be certain what is being injected or if syringes are sterile, suggesting potential onward transmission of HIV if peddlers reuse equipment (particularly high dead space syringes) after injecting someone who is HIV positive. Relatedly, reports of cocaine injection in Kisumu merit further investigation, as cocaine use has not been widely documented in Kenya. In our sample, cocaine injectors were marginally less likely to be HIV positive compared to heroin injectors. However,

our ethnographic evidence suggests that some users have limited information about the drugs they are using, while others experience erratic intoxicative effects (e.g., being high for days from cocaine), indicating potential misclassification of reported drug use. Limited knowledge and experience in injecting, shifting drug markets, or differential preparation of cocaine vs. heroin (e.g., heating drugs) influencing HIV virulence (Ciccarone, 2005) could contribute to disparate rates of HIV infection. Understanding variable patterns of drug use in emergent markets is important in determining appropriate drug treatment and promoting national policies amenable to local contexts.

Our research has limitations. Our cross-sectional study had limited power to detect statistically significant associations and we were unable to fit multivariable models. Women are estimated to comprise 5–10% of heroin users in Kenya (Beckerleg et al., 2006); our sample was 16% women, but the small absolute number ( $n = 24$ ) warrants caution in interpreting results. We also relied on self-reported data, including HIV status. Although nearly everyone disclosed an HIV result, women may have been more willing to share a positive result than men, thereby biasing our results.

Despite the constraints, this research provides evidence of injection drug use in the Nyanza region of Kenya that can inform ongoing prevention efforts. Our work suggests that injection may be shifting into new contexts: in Kisumu, patterns of poly-drug and alcohol use and reported cocaine injection differ from established epicenters of heroin injection elsewhere in Kenya, yet few resources are available to address injection-related harms. Furthermore, sexual risk and STI symptomology suggest that unmet sexual health needs should be addressed in interventions for injectors. Future research should

**Table 2**

Associations with self-reported HIV infection among people who inject drugs in Kisumu, Kenya: Odds Ratios (OR) and Odds Ratios adjusted for sex (AOR),  $n = 139$  who reported an HIV test result.

Factors <sup>a</sup>	HIV+ <sup>b</sup> $n = 27$	HIV- <sup>b</sup> $n = 112$	Univariable models			Adjusted models		
			OR	95% CI	$p$	AOR	95% CI	$p$
<b>Socio-demographics</b>								
Female	10 (37%)	13 (12%)	4.5	1.7, 11.8	.003	–	–	–
Age (Mean $\pm$ sd)	29.8 $\pm$ 4.9	28.6 $\pm$ 6.5	1.0	0.9, 1.1	.36	1.1	0.9, 1.1	.10
Born in Kisumu	22 (81%)	77 (69%)	2.0	0.7, 5.7	.20	1.6	0.6, 4.8	.37
Lived in Nyanza entire life	20 (74%)	59 (53%)	2.6	1.0, 6.6	.05	1.7	0.6, 4.8	.29
<High school education	<b>17 (63%)</b>	<b>43 (38%)</b>	<b>2.7</b>	<b>1.1, 6.5</b>	<b>.02</b>	<b>2.3</b>	<b>0.9, 5.6</b>	<b>.08</b>
No spouse/steady partner	14 (52%)	36 (32%)	2.3	0.9, 5.3	.06	1.8	0.7, 4.4	.21
<b>Sexual Behaviors</b>								
Unprotected sex, past 30 days	20 (74%)	62 (55%)	2.3	0.9, 5.9	.08	1.9	0.7, 5.0	.19
Drunk or high during sex, past 30 days	19 (70%)	71 (63%)	1.4	0.6, 3.4	.50	1.4	0.5, 3.6	.49
Ever traded sex for money	14 (52%)	41 (37%)	1.9	0.8, 4.4	.15	1.4	0.6, 3.5	.45
<b>Ever traded sex for drugs</b>	<b>8 (30%)</b>	<b>10 (9%)</b>	<b>4.3</b>	<b>1.5, 12.3</b>	<b>.007</b>	<b>2.8</b>	<b>0.9, 8.8</b>	<b>.08</b>
<b>Ever any STI symptoms</b>	<b>19 (70%)</b>	<b>42 (38%)</b>	<b>4.0</b>	<b>1.6, 9.8</b>	<b>.003</b>	<b>4.6</b>	<b>1.7, 12.0</b>	<b>.002</b>
<b>Injection risk behaviors</b>								
First injected in Kisumu	17 (65%)	64 (57%)	1.4	0.6, 3.5	.44	1.1	0.4, 2.8	.85
Know how to inject	21 (78%)	89 (79%)	0.9	0.3, 2.5	.85	1.2	0.4, 3.5	.76
<b>Ever injected by peddler<sup>c,d</sup></b>	<b>8 (44%)</b>	<b>20 (22%)</b>	<b>2.8</b>	<b>1.0, 8.0</b>	<b>.06</b>	<b>2.9</b>	<b>1.0, 8.5</b>	<b>.05</b>
<b>Injected heroin, past 30 days<sup>e</sup></b>	<b>13 (48%)</b>	<b>31 (28%)</b>	<b>2.4</b>	<b>1.0, 5.7</b>	<b>.04</b>	<b>2.3</b>	<b>1.0, 5.7</b>	<b>.06</b>
Shared syringe/needle, past 30 days <sup>d</sup>	15 (58%)	45 (43%)	1.8	0.8, 4.3	.18	2.1	0.8, 5.3	.11
<b>Shared syringe/needle b/c no access, past 30 days</b>	<b>8 (30%)</b>	<b>11 (10%)</b>	<b>3.9</b>	<b>1.4, 10.9</b>	<b>.01</b>	<b>3.6</b>	<b>1.2, 10.5</b>	<b>.02</b>
Shared cooker, past 30 days	24 (89%)	81 (72%)	3.1	0.9, 10.9	.08	2.7	0.7, 9.7	.14
Ever "Flashed" (injected blood)	5 (19%)	11 (10%)	2.1	0.7, 6.6	.21	2.4	0.7, 8.1	.15

<sup>a</sup> Unadjusted and adjusted logistic regression models tested socio-demographics, sexual risk behaviors, and drug-related risks with theoretical, biological, or ethnographic relevance to HIV infection; all adjusted models are adjusted for sex. Risk factors in the adjusted models at the  $p < .10$  level are in bold.

<sup>b</sup> Percentages provided are based on column totals (HIV+ vs. HIV-).

<sup>c</sup> Responses do not add up to the total number of participants because the question was added to the survey later based on emergent ethnographic evidence.

<sup>d</sup> Responses dichotomized to "Always/Often/Sometimes" vs. "Rarely/Never".

<sup>e</sup> Reported only heroin injection (brown or white powdered forms) vs. any cocaine injection (including  $n = 10$  who also reported heroin injection).

integrate ethnography with bio-behavioral surveillance data to investigate drug pharmacology and assess predictors of incident HIV. We also call for expanded HIV prevention programming before injection drug use amplifies the epidemic in western Kenya and beyond.

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None.

### Contributors

JLS conceived of the study, collected data, ran preliminary statistical analyses, and wrote the initial draft of the manuscript; KA, SO, SAS, CSC, EO, PO, and KDW helped write and provided comments on the manuscript; GR and KA collected data; JP conducted the final data analysis; and all authors read and approved the final version of the manuscript.

### Conflict of interest

No conflict declared.

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