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## Unsafe Injection and Sexual Risk Behavior among Injecting Drug Users in Georgia

Ivdivy Chikovani, Ivana Bozicevic, Ketevan Goguadze, Natia Rukhadze, and George Gotsadze

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**ABSTRACT** *Injection drug users (IDUs) are at risk for acquiring human immunodeficiency virus (HIV) through parenteral and sexual transmission. In this paper, we describe the prevalence and correlates of unsafe drug injecting and sexual behaviors among IDUs recruited across five cities in Georgia in 2009. IDUs were administered a questionnaire collecting information on demographics, drug use, sexual behaviors, and HIV testing behaviors. Correlates of risky injecting and sexual behaviors were determined using logistic regression. Of 1,127 IDUs, the majority (98.7%) were men, and the median duration of injecting drugs was 7 years. Unsafe injecting behavior at last injection was reported by 51.9% of IDUs, while 16.8% reported both unsafe injecting behavior and not using condoms with last occasional and/or commercial partner. In the multivariate analysis, independent correlates of unsafe injecting behavior at last injection were types of drugs injected [ $p=0.0096$ ; (for ephedrine, adjusted odds ratio (aOR)=7.38; 95% CI, 1.50–36.26)] and not using condoms at last commercial sex (aOR=2.29, 1.22–4.32). The following variables were significantly associated with unsafe injecting behavior at last injection and not using condoms at last sex with commercial and/or occasional partners in the multivariate analysis: marital status [ $p=0.0002$ ; (for divorced, widowed, and separated aOR=2.62, 1.62–4.25; for single aOR=1.61, 1.08–2.39)], being a member of a regular injecting group (aOR=0.62, 0.44–0.88), types of drugs injected in the past month [ $p=0.0024$ ; (for buprenorphine aOR=0.34, 0.18–0.63)], city of residence ( $p=0.0083$ ), and not receiving information on HIV (aOR=1.82, 1.07–3.09). Though only ephedrine was injected by a smaller number of IDUs (9.1%), the vast majority of these (81.4%) reported unsafe injecting practices at last injection. High prevalence of unsafe injecting behaviors and diverse and at-risk sexual partnerships highlight the need to implement complex and targeted HIV interventions among IDUs in Georgia.*

**KEYWORDS** *Injecting drug users, HIV, Sexual behavior, Georgia*

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### INTRODUCTION

Injecting drug use has been at the forefront of the explosive spread of human immunodeficiency virus (HIV) in the countries of eastern Europe.<sup>1–3</sup> In Georgia, the first HIV case was documented in 1989, and up to end of 2009, 2,167 cases of HIV were reported. Sixty percent of all HIV cases reported since 1989 were attributed to

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Chikovani, Goguadze, Rukhadze, and Gotsadze are with the Curatio International Foundation, Tbilisi, Georgia; Bozicevic is with the WHO Collaborating Centre for Capacity Development in HIV Surveillance, School of Medicine, Zagreb, Croatia.

Correspondence: Ivdivy Chikovani, Curatio International Foundation, 37d I. Chavchavadze Avenue, Tbilisi, 0162, Georgia. (E-mail: I.Chikovani@curatio.com)

injecting drug use, while heterosexual and male-to-male transmission contributed to 34% and 2.5% of all cases, respectively.<sup>4</sup>

The second generation HIV surveillance was established in Georgia in the mid 2000s. Based on the results of the surveys carried out among injecting drug users (IDUs) in the cities of Tbilisi and Batumi in 2004, 6.7% and 10.5% of IDUs, respectively, reported using needles or syringes at last injection that were previously used by someone else, while prevalence of HIV was 0.4% and 2.1%, respectively.<sup>5</sup> The surveys carried out in the same cities in 2006 found that the reported use of needles or syringes at last injection that were previously used by someone else was 10.0% in Tbilisi and 3.5% in Batumi.<sup>6</sup> HIV prevalence in 2006 in Tbilisi was 0% and in Batumi 3.6%, while hepatitis C prevalence was 64.6% and 76.4%, respectively. In Tbilisi, 54.0% of IDUs reported condom use with occasional partners and 80.4% with commercial partners in 2006, while lower rates (37.9% and 57.1%, respectively) were found in Batumi.

In this paper, we describe the patterns of HIV-related injecting and sexual risk behavior from cross-sectional surveys carried out in 2009 among IDUs in five cities in Georgia, and the predictors of these behaviors.

## MATERIALS AND METHODS

### Study Design

The surveys among IDUs were conducted in five cities (Tbilisi, Gori, Telavi, Zugdidi, and Batumi) by respondent-driven sampling (RDS). RDS has been used in various settings to recruit hard-to-reach populations, and its methodology is described in detail elsewhere.<sup>7-9</sup> Initial participants, called *seeds* in RDS, were selected in collaboration with the non-governmental organization (NGO) "Bemoni." After the completion of the behavioral and the biological part of the survey, each participant, including seeds, was given three uniquely coded non-replicable coupons to recruit three additional peers to participate in the study. Each participant was offered a financial incentive of 20 Gel (US \$12.5) for completing the behavioral and biological part of the study, and an additional incentive of 7 Gel (US \$4.4) for each eligible person they recruited. The biological part of the study included testing for HIV and syphilis (the results on the prevalence of infections will be reported elsewhere).

The eligibility criteria for inclusion in the survey included the following: being 18 years or older, injected addictive substances and/or drugs for non-medical purposes at least once in the past month, and being a resident in the cities where the surveys were conducted. The assessment of whether a potential participant was an IDU or not was done by asking several questions regarding street names of drugs and prices, familiarity with drug preparation and injection techniques, and by the visual inspection for recent marks of injection.

A sample size of 300 was estimated for a survey in Tbilisi and 200 for each of the other cities.

After acquiring a written consent, participants were interviewed face-to-face by a trained interviewer. A closed-ended questionnaire assessed: (1) demographic profile, (2) injection practices, (3) sexual behavior, (4) self-reporting of sexually transmitted infections (STIs), (5) awareness of HIV-related prevention services, (6) perception of HIV risk, and (7) utilization of prevention services.

The study protocol was approved by the ethical committee of the HIV/AIDS Patients Support Foundation in Tbilisi. All data collection was anonymous and confidential.

### Measures

We describe, in this paper, the prevalence and correlates of all kinds of unsafe injecting behavior at last injection. "Unsafe injecting behavior" was defined as the occurrence of at least one of the following unsafe practices: injecting with a previously used needle or syringe; injecting with a syringe left at a place of gathering by somebody else; using a preloaded syringe; sharing equipment such as a container, cotton, or spoon; using drug solution from a shared container or drug solution diluted with somebody else's blood. We also describe patterns and correlates of "dual risk behavior" which was defined as both unsafe injecting behavior at last injection and not using condoms at last intercourse with a sex worker and/or occasional partner.

In order to explore the associations between HIV-related risk behavior and the use of specific drugs, the following distinct categories of the types of drugs used during a month prior to the survey were created: heroin, ephedrine, buprenorphine, multiple, and other drugs. "Other drugs" include morphine, methadone, and opium, which were injected by a small number of IDUs. If different substances were added to the drug to prolong its desired effect or minimize adverse effects (for example, antihistamines) the person was attributed to the category indicated by the basic drug.

### Statistical Methods

Bivariate and multivariate analyses were done using logistic regression. Multivariate logistic regression was undertaken to compare the likelihood of unsafe injecting and sexual behavior across socio-demographic and behavioral categories, and accessibility of HIV testing and information on HIV from NGOs or health care providers. Results are presented as odds ratios (OR) with 95% confidence intervals (95% CI). Variables significant in the bivariate analysis ( $p < 0.05$ ) were included in the multivariate logistic regression analysis. Data from the cities were grouped together and analyzed to obtain a higher sample size and were treated as a convenience sample as RDS Analysis Tool cannot perform multivariate analysis. Analysis of data was performed using STATA 8.0.<sup>10</sup> Missing values were excluded from the analyses.

## RESULTS

### Background Characteristics

The sample included 1,127 participating IDUs, of whom there were only 15 females. The sample sizes per city were as follows: Tbilisi, 307; Gori, 205; Telavi, 205; Zugdidi, 204; Batumi, 206.

The median length of injection drug use was 7 years (interquartile range [IQR], 3–15). Starting injection drugs by the age of 16 years was reported by 10.2% of participants, while 55.7% started using injection drugs after the age of 21 years. Injecting for 4 years or less was reported by 34.1% of IDUs, while 42.7% injected for longer than 10 years. Ninety-seven percent reported that they could get new, unused syringes when needed, and 94.9% mentioned drug stores as a primary source of syringes. In terms of the types of drug injected in the past month, only

heroin was injected by 33.8% of IDUs, only buprenorphine by 17.8%, and only ephedrine by 9.1%, while 36.2% injected multiple types of drugs and 3.2% injected other drugs. The use of heroin in the past month was reported by overall 57.6% of IDUs which makes it the most common type of drug injected, either alone or in combination with other drugs.

Ninety-two percent of IDUs reported having sexual intercourse in the past 12 months. The median number of partners in the past 12 months was 3 (IQR, 1–6), and 70.9% of those who reported having sexual partners had more than one partner in the previous 12 months. Seventy-seven percent in the overall sample reported having a regular partner in the past 12 months, and the median number of such partners was 1 (IQR, 1–1). Occasional partners were reported overall by 47.9% of respondents, and the median number of such partners in the past 12 months was 3 (IQR, 2–7). Having paid partners in the past 12 months was reported by slightly more than a quarter of IDUs (27.5%), and the median number of such partners was 3 (IQR, 2–5).

Condom use at last sex with regular partners was 20.9%, 48.5% with occasional partners, and 77.8% with female sex workers. Even a quarter of those who had regular partners reported having a commercial partner in the past year, and 47.6% reported an occasional partner. Of male IDUs, 1.9% had ever had a male partner.

Unsafe injecting behaviors at last injection were reported by 51.9% of respondents. Unsafe injection practices at last injection were distributed as follows: 46.4% shared equipment such as a container, bottle, spoon, cotton, or filter; 19.4% used solution from a shared container; 6% injected with a previously used needle or syringe; 2.4% used a pre-filled syringe; 0.9% used a needle or a syringe left at a place of gathering; and 0.2% used a solution diluted with somebody else's blood. Both unsafe injecting behavior at last injection and not using condoms at last sex with a commercial and/or occasional partner was reported by 16.8% of IDUs.

Of the IDUs, 99.4% knew that HIV can be transmitted through syringe sharing, and similarly high proportions (96.2%) were aware that proper condom use during every sexual contact can prevent HIV transmission.

Of respondents, 73.7% have heard about the methadone substitution program and 31.1% about the syringe exchange program; however, their services had been used by 0.8% and 7.8%, respectively.

### **Factors Predicting Unsafe Injecting at Last Injecting**

Table 1 shows the proportion of respondents who reported unsafe injecting behavior at last injection across socio-demographic and behavioral variables, and results of univariate and multivariate regression analysis. Unsafe injecting behavior at last injection was reported by slightly more than half of the respondents and was the most common, though not significantly so, in the youngest age group (18–30 years of age). Those with only primary and secondary school education had the highest prevalence of unsafe injecting behavior (56.7%), as did those who were divorced, separated, or widowed (60.3%) compared to other marital categories. The experience of imprisonment, duration and frequency of drug use, and membership of a regular injecting group were not significantly associated with unsafe injecting behavior. The vast majority (81.4%) of those who injected ephedrine reported unsafe injecting behavior compared to those who injected buprenorphine (32.5%) and multiple and other drugs (47.9%). Significantly lower reporting of unsafe last injection was observed among those who had ever had an HIV test (44.2%) compared to those who had not. There were significant differences in the reporting of unsafe drug use across the cities, and the highest prevalence of unsafe behavior

**TABLE 1** Factors associated with unsafe last injection among IDUs in five cities in Georgia, 2009

	Unsafe injection at last injecting drug use (%)	Base	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Prevalence	51.9	1,127		
Age			$p=0.2125$	$p=0.3070$
18–30	55.3	378	1.0	1.0
31–40	48.9	398	0.78 (0.56–1.03)	1.35 (0.76–2.39)
>41	51.6	351	0.86 (0.64–1.15)	0.77 (0.36–1.65)
Education			$p=0.0016$	$p=0.9489$
Primary/secondary	56.7	619	1.0	1.0
Incomplete higher	49.1	55	0.74 (0.42–1.27)	1.02 (0.33–3.10)
Higher	45.7	453	0.64 (0.50–0.82)	0.92 (0.55–1.56)
Marital status			$p=0.0253$	$p=0.7157$
Married	48.4	560	1.0	1.0
Divorced, widowed, separated	60.3	146	1.61 (1.12–2.34)	1.06 (0.44–2.51)
Single	53.7	421	1.23 (0.96–1.6)	1.26 (0.72–2.23)
Been imprisoned ever			$p=0.9349$	
No	51.9	993	1.0	1.0
Yes	52.2	134	1.01 (0.71–1.46)	
Duration of injecting drug use			$p=0.7752$	
<4 years	53.4	384	1.0	
5–9 years	51.2	262	0.91 (0.67–1.25)	
>10 years	51.1	481	0.91 (0.70–1.20)	
Daily frequency of injection			$p=0.2867$	
No	45.9	416	1.0	
Yes	51.0	147	1.23 (0.84–1.79)	
Membership of regular injecting group			$p=0.7126$	
No	51.1	331	1.0	
Yes	52.3	796	1.04 (0.81–1.36)	
Types of drugs injected in the past month			$p<0.0001$	$p=0.0096$
Heroin	58.8	381	1.0	1.0
Ephedrine	81.4	102	3.06 (1.79–5.25)	7.38 (1.50–36.26)

TABLE 1 (continued)

	Unsafe injection at last injecting drug use (%)	Base	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Buprenorphine	32.5	200	0.34 (0.24–0.48)	0.52 (0.24–1.13)
Multiple/Other	47.9	444	0.65 (0.49–0.85)	0.98 (0.52–1.82)
Tested on HIV			$p=0.0009$	$p=0.1379$
Yes	44.2	326	1.0	1.0
No	55.1	801	1.55 (1.19–2.01)	1.50 (0.88–2.58)
City of residence			$p<0.0001$	$p=0.3996$
Tbilisi	37.5	307	1.0	1.0
Gori	64.4	205	3.02 (2.09–4.36)	1.31 (0.55–3.12)
Telavi	60.0	205	2.50 (1.74–3.60)	1.72 (0.71–4.15)
Zugdidi	53.4	204	1.92 (1.34–2.74)	0.93 (0.42–2.06)
Batumi	51.5	206	1.77 (1.24–2.53)	0.76 (0.34–1.68)
Received information on HIV last year <sup>a</sup>			$p=0.4063$	
Yes	49.3	201	1.0	
No	52.5	926	1.14 (0.84–1.54)	
Condom use with sex worker at last sex			$p=0.0071$	$p=0.0102$
Yes	52.0	246	1.0	1.0
No	70.6	60	2.21 (1.24–3.95)	2.29 (1.22–4.32)

*P* values represent significance test for heterogeneity across the variable

OR odds ratio

<sup>a</sup>Information received from a doctor or a professional trained in harm reduction among IDUs or information provided on printed materials (leaflets) produced by NGOs that work on harm reduction

**TABLE 2** Factors associated with unsafe last injection and unprotected last sex with sex worker or occasional partner among IDUs in five cities in Georgia, 2009

	Unsafe injection and sexual behavior (%)	Base	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Prevalence	16.8	1,127		
Age			$p=0.0318$	$p=0.1691$
18–30	20.9	378	1.0	1.0
31–40	14.8	398	0.66 (0.45–0.95)	0.69 (0.46–1.04)
>41	14.5	351	0.64 (0.44–0.95)	0.72 (0.45–1.15)
Education			$p=0.0227$	$p=0.8281$
Primary/secondary	19.6	619	1.0	1.0
Incomplete higher	14.6	55	0.70 (0.32–1.52)	0.83 (0.37–1.87)
Higher	13.3	453	0.63 (0.45–0.88)	0.91 (0.63–1.32)
Marital status			$p=0.0001$	$p=0.0002$
Married	12.0	560	1.0	1.0
Divorced, widowed, separated	24.7	146	2.41 (1.53–3.79)	2.62 (1.62–4.25)
Single	20.4	421	1.89 (1.33–2.68)	1.61 (1.08–2.39)
Been imprisoned ever			$p=0.2657$	
No	16.3	993	1.0	1.0
Yes	20.2	134	1.29 (0.82–2.04)	2.62 (1.62–4.25)
Duration of injecting drug use			$p=0.4137$	
<4 years	15.1	384	1.0	1.0
5–9 years	19.1	262	1.33 (0.87–2.01)	1.33 (0.87–2.01)
>10 years	16.8	481	1.14 (0.79–1.64)	1.14 (0.79–1.64)
Daily frequency of injection			$p=0.5571$	
No	14.9	416	1.0	1.0
Yes	12.9	147	0.85 (0.49–1.47)	0.85 (0.49–1.47)
Membership of regular injecting group			$p=0.0013$	$p=0.0072$
No	22.4	331	1.0	1.0
Yes	14.5	796	0.59 (0.42–0.81)	0.62 (0.44–0.88)
Types of drugs injected in the past month			$p=0.0023$	$p=0.0024$
Heroin	19.4	381	1.0	1.0
Ephedrine	22.6	102	1.21 (0.71–2.05)	0.95 (0.51–1.76)

TABLE 2 (continued)

	Unsafe injection and sexual behavior (%)	Base	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Buprenorphine	8.0	200	0.36 (0.20–0.64)	0.34 (0.18–0.63)
Multiple/other	17.1	444	0.86 (0.60–1.22)	1.04 (0.69–1.54)
Tested on HIV			$p=0.0169$	$p=0.2359$
Yes	12.6	326	1.0	1.0
No	18.5	801	1.58 (1.01–2.29)	1.28 (0.85–1.95)
City of residence			$p=0.0005$	$p=0.0083$
Tbilisi	8.8	307	1.0	1.0
Gori	21.0	205	2.75 (1.64–4.62)	2.69 (1.51–4.80)
Telavi	22.0	205	2.92 (1.74–4.88)	2.55 (1.43–4.57)
Zugdidi	17.2	204	2.15 (1.26–3.67)	1.85 (1.03–3.35)
Batumi	18.9	206	2.42 (1.43–4.10)	1.87 (1.00–3.49)
Received information on HIV last year <sup>a</sup>			$p=0.0050$	$p=0.0275$
Yes	9.9	201	1.0	1.0
No	18.3	926	2.02 (1.24–3.30)	1.82 (1.07–3.09)

*P* values represent significance test for heterogeneity across the variable

OR odds ratio

<sup>a</sup>Information received from a doctor or a professional trained in harm reduction among IDUs or information provided on printed materials (leaflets) produced by NGOs that work on harm reduction



was reported in Gori (64.4%) and Telavi (60.0%). Those who did not use a condom at last sex with a sex worker reported unsafe drug use behavior significantly more often.

In the multivariate analysis, the variables that remained significantly associated with reporting of unsafe injecting behavior were types of drugs injected in the past month ( $p=0.0096$ ) and not using a condom with a sex worker at last sex (adjusted odds ratio (aOR)=2.29; 95% CI, 1.22–4.32;  $p=0.0102$ ). Those who injected ephedrine had a significantly higher likelihood of reporting unsafe injecting behavior (aOR=7.38; 95% CI, 1.50–36.26) compared to those who injected only heroin.

### **Factors Associated with Unsafe Injecting and Sexual Behavior**

Table 2 illustrates the distribution and correlates of “dual risk behaviors,” which have been defined as the reporting of unsafe injecting behavior at last injection and not using condoms at last intercourse with a commercial and/or occasional partner. In the bivariate analysis, the prevalence of both unsafe injecting and sexual behavior was significantly higher in the youngest age group (20.9%) compared to those who were older age groups. It was significantly lower among those with higher education (13.3%) compared to other educational categories, and among married individuals (12.0%) compared to those who were divorced, widowed, separated, and single. Those who were not members of regular injecting groups had significantly higher reporting of unsafe sexual and drug injecting behavior (22.4%). Those who injected buprenorphine had the lowest reporting of unsafe injecting and sexual behavior (8.0%), as had those who tested for HIV (12.6%) and those who received qualified information on HIV in the last year (9.9%). Living in the cities other than Tbilisi was significantly associated with “dual risk behaviors.”

In multivariate analysis, experience of last unsafe injection and sexual behavior was significantly higher among divorced, widowed, or separated (aOR=2.62; 95% CI, 1.62–4.25) and single individuals (aOR=1.61; 95% CI, 1.08–2.39) compared to those who were married. Those who were members of regular injecting groups had lower odds of unsafe behavior (aOR=0.62; 95% CI, 0.44–0.88) compared to those who were not, as had those who injected buprenorphine (aOR=0.34; 95% CI, 0.18–0.63) compared to those who injected heroin. Living in all other cities (Gori, Telavi, Zugdidi, and Batumi) was associated with higher odds of unsafe behavior ( $p=0.0083$ ) compared to living in Tbilisi. Not receiving information on HIV in the past year significantly increased the experience of unsafe injecting and sexual behavior (aOR=1.82; 95% CI, 1.07–3.09).

Prevalence of HIV per city was as follows: Tbilisi, 2.3%; Gori, 0%; Telavi, 1.5%; Zugdidi, 1.5%; and Batumi, 4.4%. Prevalence of syphilis was: Gori, 3.9%; Telavi, 5.5%; Tbilisi, 6.3%; Zugdidi, 6.9%; Batumi, 7.6%.

## **DISCUSSION**

We found high levels of risky injecting and sexual behavior among IDUs in Georgia.

The multivariate model of unsafe injecting behavior revealed that the type of drug injected and not using condoms at last sex with an occasional or commercial partner were significant correlates of unsafe last injection. Those who injected ephedrine in the past month had the significantly higher likelihood of unsafe injecting compared with other types of drugs.

Ephedrine is a psychostimulant that causes amphetamine-like effects and results in increased impulsivity and sexual activity.<sup>11–12</sup> In a study carried out in St.

Petersburg, the Russian Federation, frequent stimulant use was found to be the primary factor associated with HIV seroconversion.<sup>13</sup> Our finding that IDUs practicing higher injection-related risk behavior are more likely to be practicing higher sexual risk behavior is consistent with other research findings.<sup>14–19</sup>

There is some evidence from other studies in line with our results that those injecting buprenorphine might have lower HIV-related risky injection practices.<sup>20–21</sup> A study carried out recently by Otiashvili et al. among IDUs in Georgian needle exchange programs found that two thirds of IDUs injected buprenorphine in the past month and approximately a half of these used it to cope with the symptoms of withdrawal.<sup>22</sup> Buprenorphine (commercially known as Subutex®) is used to treat opioid addiction and is not legally available in Georgia. Buprenorphine enters Georgia via the black market mainly from Europe and has become a common injection drug in Georgia since 2004.<sup>23</sup> Since 2008, the use of buprenorphine has reportedly been decreasing in favor of home-made synthetic stimulants (ephedrine/methcathinone) prepared through a chemical refinement process from pseudoephedrine that is used against respiratory disorders and is easily available from drugstores without a prescription.<sup>19</sup> In 2006 in Tbilisi and Batumi, 7.5% and 1.0% of IDUs, respectively, reported injecting ephedrine during the week prior to the survey compared to 15.6% and 11.5%, respectively, from the results of our surveys carried out in 2009.<sup>5–6</sup> This trend is worrying considering higher odds of unsafe injection behavior found among those who injected ephedrine in our study. These findings suggest that the information on the types of drugs used should be considered in designing and implementation of harm reduction programs.

We observed high rates of multiple sexual partnering and an overlapping of unsafe injecting and sexual behavior. A quarter of those who had regular partners in the past year reported having also commercial partners, and half reported having occasional partners. As condom use is low in the majority of these diverse partnerships, there is a clear risk of a sexual HIV epidemic among IDUs and transmission of HIV and other STIs to their sexual partners.

An interesting finding was that IDUs who are married and those who are members of regular injection groups had a lower likelihood of unsafe injecting and sexual behavior. This protective effect of community membership should be used in delivering peer education and social network interventions.<sup>24</sup> Social networks have been found to play a role in the initiation, continuation, and cessation of both injecting drug use and HIV risk behavior.<sup>25</sup>

There are substantial city-level differences in risk behavior, and the highest prevalence of unsafe injecting and sexual behavior was found in Telavi and Gori. Although IDUs in these cities had the lowest HIV prevalence (1.5% and 0%, respectively), there is a conducive environment for the rapid spread of HIV infection. Although we found that those in the youngest age group (18–30 years of age) had a higher likelihood of unsafe injecting and sexual behavior compared to the other age groups, this increased likelihood was not attained in the multivariate analysis. Nevertheless, young injectors should be a subpopulation targeted with specific interventions.<sup>26</sup> Some nonsignificant results are noteworthy, such as lack of association between imprisonment and frequency of injecting and unsafe injecting and sexual behavior.

It is encouraging that only 6% of IDUs reported receptive needle or syringe sharing at last injection, which is the riskiest injection behavior. This can be explained by easy access to syringes at the pharmacies and satisfactory knowledge among IDUs about the risk of HIV transmission through syringe sharing. However, it is worrisome that a high proportion (46.4%) share paraphernalia other than

needles or syringes. This may indicate that prevention programs do not adequately emphasize the harm of sharing other paraphernalia in addition to needle and syringe sharing.

There are several important findings from this study. Firstly, we found that a high proportion of respondents had multiple sexual partners, and a considerable proportion of IDUs did not use condoms at last sex with occasional partners and sex workers. HIV interventions among IDUs in Georgia should consist of dual risk-reduction interventions, which imply that, along with addressing safe injection practices, they should also focus on sexual health and prevention of STIs among IDUs and their partners. Secondly, drug users in Georgia who inject only stimulants constitute a small but specific subgroup for HIV acquisition and transmission and should be a target of specific interventions that emphasize increased exposure to HIV associated with use of psychostimulants. Thirdly, due to significantly higher levels of unsafe sexual and injecting behavior in the cities outside of Tbilisi, HIV prevention activities should clearly be intensified in these areas to achieve better quality of services. Fourthly, there is a need to explore patterns of drug injecting equipment sharing in IDU networks as that will help to develop appropriate interventions among the interconnected populations of IDUs.<sup>27</sup> Reconfiguration of social networks has been one of the guiding strategies of network-based interventions, which can include selection of peer leaders and delivery of sterile injecting materials and prevention messages.<sup>28–29</sup>

## LIMITATIONS

Although the city-level data were collected by RDS, the total sample for this study was analyzed as a convenience sample in order to carry out multivariate analysis and obtain a sample of a higher sample size. Behavioral and other data collected by face-to-face interviews are self-reported and may therefore be subject to social desirability and other biases. However, interviews were carried out by trained interviewers, and respondents were recruiting each other by a chain referral method from the communities, which might have contributed to better validity of self-reported behavior.

## CONCLUSIONS

In conclusion, we have demonstrated the effect of individual and community characteristics on HIV-related behavior among IDUs from five cities in Georgia. The findings underscore the importance of urgent inclusion of individual and social network harm reduction interventions in ongoing HIV prevention programs in Georgia. There is a geographical clustering of risk of exposure to HIV, particularly of dual risks composed of unsafe injecting and sexual behavior. Evidence of these city differences in exposure to HIV indicates that there is a need to act on the environmental factors that can serve as pathways for further HIV transmission.

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