

Published in final edited form as:

*J Public Health (Oxf)*. 2008 June ; 30(2): 119–125. doi:10.1093/pubmed/fdn014.

## High-prevalence and high-estimated incidence of HIV infection among new injecting drug users in Estonia: need for large scale prevention programs

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### Abstract

**Objective**—To examine HIV risk behavior and HIV infection among new injectors in Tallinn, Estonia.

**Design and methods**—Data from two cross-sectional surveys of injecting drug users (IDUs) recruited from a syringe exchange program ( $N = 162$ , Study 1) or using respondent driven sampling ( $N = 350$ , Study 2). Behavioral surveys were administered; serum samples were collected for HIV testing. Subjects were categorized into new injectors (injecting  $\leq 3$  years) and long-term injectors (injecting  $> 3$  years).

**Results**—Twenty-eight of 161 (17%, Study 1) and 73/350 (21%, Study 2) of the study subjects were new injectors. HIV infection was substantial among the newer injectors: HIV prevalence was 50% (Study 1) and 34% (Study 2), and estimated HIV incidence 31/100 PY and 21/100 PY, respectively. In Study 2, new injectors were more likely to be female and ethnic Estonian and less likely to be injecting daily compared with long-term injectors. No significant difference was found among two groups on sharing injecting equipment or reported number of sexual partners.

**Conclusions**—A continuing HIV epidemic among new injectors is of critical public health concern. Interventions to prevent initiation into injecting drug use and scaling up HIV prevention programs for IDUs in Estonia are of utmost importance.

## Keywords

Estonia; HIV; IDU; injection drug use; new injecting drug users

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## Introduction

Estonia has a rapidly expanding injecting drug user (IDU) driven HIV epidemic. HIV infection entered the IDU community in Estonia in early 2000s.<sup>1,2</sup> By 2005, the rate of newly reported HIV cases in Estonia was 467 per million inhabitants, the highest per capita rate in Eastern Europe, almost twice the rate of 247 per million inhabitants in Russia, which had the second highest rate in Eastern Europe.<sup>3,4</sup> Only limited information on the prevalence and trends of HIV infection among IDUs in Estonia is available, but it is clear that major increases in both injecting drug use and HIV among drug injectors have occurred over the last decade.

Similar to other Newly Independent States (NISs) of the former Soviet Union, Estonia has experienced major political, economic and social changes over the last 15 years. Economic displacement and the disruption of personal, domestic and inter-community networks, have fueled several overlapping epidemics: increased violence, high-risk sexual behavior, substance abuse and infectious diseases (HIV, sexually transmitted diseases, tuberculosis).<sup>5,6</sup> This has led to large increases in morbidity and mortality.<sup>7</sup> There has been a dramatic growth in the extent of drug injecting in Estonia since late 1990.<sup>1</sup>

Recent initiates into illicit drug injection (new injectors) create special problems for HIV prevention. First, new injectors may increase the size of the local IDU population, increasing the need for prevention and treatment services. Second, new injectors may not self identify as IDUs, may not fully appreciate the need to protect themselves against HIV and other blood-borne diseases, and may find HIV prevention and drug services difficult to access. Many, though not all, studies have found higher rates of injecting risk behavior and blood-borne infections among new injectors.<sup>8–10</sup> Cohort studies have shown very high incidence of hepatitis C infection among recent initiates to injecting.<sup>11,12</sup>

Previous studies of HIV among IDUs in Estonia have examined prevalence and risk behavior among the samples as a whole and by demographic subgroups. In this report, we examine levels of risk behavior and HIV infection among new injectors from two studies conducted in Tallinn, Estonia in 2004 and 2005.

## Methods

Two cross-sectional studies were designed to assess the prevalence of HIV and risk behavior among IDUs in Estonia. Detailed descriptions of the studies are provided elsewhere.<sup>13,14</sup> In both the studies, current IDUs were recruited for an interviewer-administered risk behavior survey covering demographics, drug use history, and HIV risk behavior, and biological sample collection for HIV testing.

Study 1<sup>13</sup> was conducted in 2004 and recruited a convenience sample of 162 IDUs from two syringe exchange projects in Tallinn. Eligibility criteria included reporting injecting drugs within past 90 days, and age 18 years or older. A questionnaire was administered by a trained interviewer, with questions on injecting and sexual behavior risk behaviors within last 90 days. Venous blood was collected from participants and tested for the presence of HIV antibodies using commercially available test kits (HIV-1/HIV-2 III Plus from Abbott Laboratories (Abbott Park, IL, USA) at the State HIV/AIDS reference laboratory.

Study 2<sup>14</sup> was conducted in Tallinn in 2005, and recruited 350 IDUs using respondent driven sampling (RDS).<sup>15,16</sup> Eligible participants reported injecting drugs within past 28 days and were aged 18 or older. A structured questionnaire was administered by a trained interviewer, with questions on injecting and sexual behavior risk behaviors within the last 28 days. Dried blood spot specimens were collected and tested for HIV antibodies using GACELISA, reactive specimens were confirmed using anti-HIV GACPAT immunoassay, with confirmatory testing conducted on discordant results using the HIV Blot 2.2 Western Blot assay (AbbotMurex). The testing was undertaken at the UK Health Protection Agency. Of note, assays used in both studies for detecting antibodies to HIV had high sensitivity and specificity.<sup>17–19</sup>

The wording in questionnaires was exactly the same for key variables (gender, ethnicity, age at IDU initiation) in both studies, though the time frame of measurement for recent drug use and risk behavior differed (last 90 days in Study 1 and last 28 days in Study 2). Subtraction of age at first injection from current age gave a measure of the number of years injecting.

We defined ‘new injectors’ in each survey wave as persons who reported their first injection as occurring within 3 years of the study interview. For calculating time since first injection, we assigned persons who had first injected at their current age to have been injecting for 6 months, persons who first injected in the previous year to have been injecting for 1 year, persons who had first injected 2 years prior to their current age to have been injecting for 2 years, and persons who had first injected 3 years prior to their current age to have been injecting for 3 years.

We then estimated HIV incidence among new injectors using the following assumptions: (i) all of them were HIV seronegative when they began injecting; (ii) the HIV seropositives became infected at the midpoint between beginning to inject and the time of blood sample collection and (iii) no HIV seropositives are lost to AIDS or other causes among the new injectors.

The time at risk for HIV seronegative new injectors is the total time from first injection to the time of the interview. The estimated HIV incidence rate was the number of HIV seropositive new injectors divided by the sum of the time at risk for the HIV seropositive new injectors (one-half total time from beginning to inject to time of interview) and the time at risk for the HIV seronegative new injectors (total time from beginning to inject to time of interview).<sup>20</sup>

### Statistical analysis

Risk behaviors and characteristics were compared between the two groups of IDU (new and long-term injectors). Pearson's  $\chi^2$ -tests were used for categorical variables and *t*-tests with equal variance for continuous variables. RDS analysis Tool v. 5.0.1<sup>16,21</sup> was used to weight the sample to control for differences in network size and homophily (the principle that contact between similar people occurs at a higher rate than among dissimilar people<sup>22</sup>) to provide population-based estimates of the characteristics of IDU (Study 2 only).

In order to facilitate comparisons with Study 1, the Study 2 data presented are the observed values for the subjects.

### Ethics

Ethical approval was obtained from the Ethics Review Board of the University of Tartu (Studies 1 and 2), and from the Riverside Research Ethics Committee, UK (Study 2).

## Results

Table 1 presents socio-demographic and drug use characteristics of subjects for both studies. In Study 1 (convenience sample,  $N = 162$ ) no significant differences were found among new and long-term injectors with the exception that new injectors were younger at the time of the survey and fewer of them began injecting at very young ages (age at IDU initiation  $\leq 16$  years, 18% among new injectors versus 48% among long-term injectors,  $P = 0.006$ ). In Study 2 (respondent driven sample,  $N = 350$ ) new injectors were also younger at the time of the survey and fewer had begun injecting at very young ages (age at IDU initiation  $\leq 16$  years 37% versus 52%,  $P = 0.03$ ). The new injectors in Study 2 were more likely to be female (26% versus 14%,  $P = 0.02$ ), ethnic Estonian (22% versus 12%,  $P = 0.02$ ) and less likely to inject daily than long-term injectors (22% versus 42%,  $P = 0.002$ ).

In order to facilitate comparisons with Study 1, Study 2 data presented in Table 2 are the observed values for the subjects, unadjusted for recruitment biases. This has the effect of treating Study 2 as a convenience sample, similar to Study 1. Recruitment biases were explored in Study 2 sample using RDSAT to adjust for differences in network size and for homophily.<sup>21</sup> Following adjustment, the population estimates were generally quite similar to the observed values. All observed sample proportions fell within the 95% confidence intervals of the RDS adjusted population estimates with two exceptions: slightly over estimating the proportion of daily injectors among new injectors, and the proportion of IDU with more than one sexual partner in the last 12 among long-term injectors (Table 2).

Table 2 presents HIV prevalence among new and long-term injectors in both the studies and the estimated HIV incidence among new injectors in both studies. HIV prevalence was high (~50%) among both new and long-term injectors, and the differences between new and long-term injectors were not statistically significant in either study. Estimated HIV incidence was also high ( $>20/100$  person-years at risk) among new injectors, and the difference between the studies was not statistically significant ( $P = 0.27$ ).

In both studies, injection and sexual risk behaviors were similar among new and long-term injectors. The percentages of subjects reporting injection and sexual risk behaviors were high, 30–40% reporting receptive sharing of needles and syringes within 90 and 28 days, respectively, and 40–60% reporting more than one sexual partner in the previous 12 months.

## Discussion

### Main findings

Both studies found new drug injectors in Tallinn to be primarily young, Russian speaking and male. Both found ~20% of current injectors to be new injectors (that is, injecting for less than 3 years) and generated high estimates of HIV prevalence (between 34 and 50%) among new injectors, as well as high estimated HIV incidence between 21 and 31 per 100 person years at risk.

### What is known already

Other studies also emphasize potentially high prevalence and incidence of HIV among recently initiated injectors.<sup>23,24</sup> Similarly, studies of hepatitis C transmission have generated high estimates of incidence among recently initiated injectors, and show that the risk of infection acquisition is highest in the early years of injection.<sup>11,12,25</sup>

## Limitations of this study

Our studies used different recruitment methods. But as two studies give very similar results despite differences in sampling we have more confidence in the results. Second, alike for both of the studies the limitations lie in the potential for information bias adherent to research on illicit drug use and sexual behavior. There is a tendency for individuals to avoid negative evaluations and project a positive view of themselves by providing self reports on behaviors that are socially desirable.<sup>26</sup> Third, the selective, constructive process of remembering makes self-reporting subject to memory biases.<sup>27</sup> To diminish potential biases of self-reporting, respondents under the immediate influence of drug and/or alcohol were excluded from the study. In addition, respondents were anonymous, and unlinked interviews were held with trained interviewers in a familiar environment.

## What this study adds

Our findings emphasize the critical importance of HIV prevention interventions targeting recently initiated injectors. In many settings, younger and new injectors may have less access to HIV prevention and helping services. They may also have less access to HIV prevention capacity and expertise.<sup>28,29</sup> At initiation particularly, new injectors may be reliant upon older more experienced injectors for assistance with injection, and while this provides an opportunity of risk regarding the shared use of equipment it is also an opportunity for peer education.<sup>30</sup> Interventions targeting new injectors with peer-interventions providing information, enhancing risk-reduction skills, and motivating behavior change through peer education training can lead to reduced injection risk behaviours.<sup>31</sup>

While we do not have data on the numbers of persons leaving the active drug injecting population through death or ceasing to inject), we note the substantial proportion of current injectors who are recent initiates in both study samples. We also found that new injectors were of older ages at initiation than long-term injectors. While studies have shown a decreasing age at initiation in many Eastern European countries, this tendency may have slowed or even reversed in some countries.<sup>32</sup> Some studies suggest that an older age at initiation is associated with fewer or less severe drug-related problems.<sup>33,34</sup>

Finally, we emphasize the critical importance of HIV prevention coverage among IDUs, especially new injectors. In Tallinn, the estimated number of injection drug users was ~10 000 by the end of 2004.<sup>35</sup> In 2005, seven syringe exchange programs were operating with approximately 230 000 syringes exchanged in Tallinn, and about 90 patients were receiving methadone substitution treatment (Trummal A, personal communication). Other cities characterized by high HIV prevalence in Eastern Europe also indicate potentially inadequate levels of HIV coverage among IDUs.<sup>36</sup> The scaling up of HIV prevention for IDUs in Estonia is of utmost importance. At the same time, there is a need for the scaling up of antiretroviral HIV treatment to reduce infectiousness and transmission behavior among HIV positive IDUs, low threshold access to drug treatment, and interventions designed to prevent or delay initiation to injection.

Additionally and especially given the high prevalence of HIV in the IDU population there is a need for interventions to reduce the risk of HIV transmission from IDUs to non-injecting sexual partners.<sup>37</sup> While reaching these groups prior to exposure presents challenges, further research is necessary to identify the characteristics associated with variability in infection rates and time to infection in order to inform tailoring of existing harm-reduction strategies.

Large-scale implementation of programs known to reduce HIV risk behavior among IDUs (community outreach, needle and syringe access programs and treatment for drug addiction (particularly methadone maintenance treatment for heroin addiction) has brought HIV

epidemics under control in a number of countries, including parts of the US<sup>38,39</sup> and Western Europe.<sup>40,41</sup> The data from the new injectors in the studies reported here, however, suggests that large scale program implementation in Estonia is a matter of great urgency.

## Acknowledgments

**Funding:** This work was supported by grants from the Estonian Science Foundation (No. 5526), and the Fogarty International Center, National Institutes of Health, USA (No. D43 TW00233 and R01 TW006990), in part by US NIH grant R01 DA 03574, in part by the UK Department for International Development Knowledge for Action in HIV/AIDS Program, and by the Global Fund to Fight AIDS, Tuberculosis and Malaria who funded this study through the National Institute for Health Development in Estonia.

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**Table 1**

Demographics and injecting risk behaviors among new vs. long-term injectors

Characteristic	Study 1 (Tallinn 2004)				Study 2 (Tallinn 2005)				OR 95% CI	P-value	OR 95% CI	P-value
	New injectors		Long-term injectors		New injectors		Long-term injectors					
	No	%	No	%	No	%	No	%				
<b>Socio-demographics</b>												
Age (years)												
≤ 20	23	82.1	33	24.8	45	61.6	60	21.7	0.07	0.17		
> 20	5	17.9	100	75.2	28	38.4	217	78.3	(0.03–0.2)	(0.10–0.31)		< 0.0001
Age in years (mean, SD)	20.5 (4.1)		24.9 (6.2)		21.1 (0.57)		25.0 (0.30)		< 0.0001	< 0.0001		< 0.0001
<b>Gender</b>												
Male	23	82.1	111	84.1	19	26.0	74.0	237	1.1	85.6		2.1
Female	5	17.9	21	15.9	54	78.1	40	14.4	(0.39–3.4)	(1.1–3.9)		0.02
<b>Ethnicity</b>												
Russian + Russian speaking	27	96.4	122	91.7	16	21.9	245	88.5	0.4	2.2		0.02
Estonian	1	3.6	11	8.3	57	78.1	32	11.6	(0.05–3.3)	(1.1–4.2)		
<b>Injecting drug use</b>												
Frequency of injection												
Less than daily	13	46.4	60	45.5	57	78.1 <sup>a</sup>	160	57.8	1.0	0.38		
Daily	15	53.6	72	54.6	16	21.9 <sup>b</sup>	117	42.2	(0.42–2.18)	(0.21–0.71)		0.002
<b>Age at IDU initiation (years)</b>												
≤ 16	5	17.9	64	48.1	27	37.0	143	51.6	4.3	1.8		
> 16	23	82.1	69	51.9	46	63.0	134	48.4	(1.5–11.9)	(1.06–3.1)		0.03
Age at IDU initiation (mean, SD)	18.5 (4.3)		17.1 (3.4)		19.1 (0.61)		16.9 (0.21)		0.06	< 0.0001		
<b>Injecting risk behaviors</b>												
Shared needles or syringes												
With in last 90 days	16	57.1	81	60.9	52	71.2	185	67.8	1.2	0.85		
With in last 28 days	12	42.9	52	39.1	21	28.8	88	32.2	(0.51–2.7)	(0.48–1.50)		NS
<b>Sexual risk behaviors</b>												
Number of sexual partners in last 12 months												

Characteristic	Study 1 (Tallinn 2004)				Study 2 (Tallinn 2005)				OR 95% CI	P-value
	New injectors		Long-term injectors		New injectors		Long-term injectors			
	No	%	No	%	No	%	No	%		
None or one	13	54.2	62	52.1	32	44.4	111	40.4 <sup>c</sup>	0.85	
More than one	11	45.8	57	47.9	40	55.6	164	59.6 <sup>d</sup>	(0.50–1.43)	NS

All observed sample proportions fell within the 95% CI of the RDS adjusted population estimates with the exception of: frequency of injection for new injectors:

<sup>a</sup>RDS proportion 86.6%, 95% CI 78.4–96.5%.

<sup>b</sup>RDS proportion 13.4%, 95% CI 3.5–21.6%

Number of sex partners in the last 12 months for older injectors.

<sup>c</sup>RDS proportion 50.3%, 95% CI 41.1–58.9%.

<sup>d</sup>RDS proportion 49.7%, 95% CI 41.1–58.9%.

**Table 2**

Prevalence among new and long-term injectors and estimated incidence for new injectors

IDUs	Study 1 (Tallinn 2004)			Study 2 (Tallinn 2005)		
	N (%)	HIV prevalence 95% CI	HIV incidence / 100 PY 95% CI	N (%)	HIV prevalence 95% CI	HIV incidence / 100 PY 95% CI
All	161 (100%)	54.7 (43.6–66.9)		350 (100%)	54.3% (48.9–59.6)	47.8% (39.4–54.1)
New injectors	28 (17.3%)	50.0 (27.3–83.9)	31.3 (17.1–52.5)	73 (20.9%)	34.2% (23.8–46.4)	35.9% (10.6–51.0)
Long-term injectors	133 (82.7%)	55.6 (43.7–69.8)		277 (79.1%)	59.6% (53.5–65.4)	51.7% (43.3–62.3)