AIDS RESEARCH AND HUMAN RETROVIRUSES
Volume 25, Number 9, 2009

DOI: 10.1089/aid.2008.0206

Characterization of the Emerging HIV Type 1 and HCV Epidemics among Injecting Drug Users in Dushanbe, Tajikistan

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Abstract

This study aimed to determine HIV, HCV, and syphilis prevalence and correlates, and to characterize the molecular epidemiology of HIV-1 among injecting drug users (IDUs) in Dushanbe, Tajikistan. A cross-sectional study assessing risk factors for HIV and HCV through an interview administered survey was conducted. A total of 491 active adult IDUs were recruited from May to November 2004 in Dushanbe, Tajikistan. HIV-1 antibody status was determined with rapid testing and confirmed with ELISA. HCV antibody testing was conducted using a BIOELISA HCV kit. HIV-1 subtyping was done on a subset with full-length sequencing. Correlates of HIV and HCV infection were assessed using logistic regression. Overall prevalence of HIV was 12.1%, HCV was 61.3%, and syphilis was 15.7%. In a multivariate logistic regression model controlling for gender and ethnicity, daily injection of narcotics [odds ratio (OR) OR 3.22] and Tajik nationality (OR 7.06) were significantly associated with HIV status. Tajik nationality (OR 1.91), history of arrest (OR 2.37), living/working outside Tajikistan in the past 10 years (OR 2.43), and daily injection of narcotics (OR 3.26) were significantly associated with HCV infection whereas being female (OR 0.53) and always using a sterile needle (OR 0.47) were inversely associated with HCV infection. Among 20 HIV-1-positive IDU with specimens available for typing, 10 were subtype A, 9 were CRF02_AG, and one was an A-CRF02_AG recombinant. Epidemics of HIV-1, HCV, and drug use are underway in Dushanbe. The molecular epidemiology is distinctive, with West African variants accounting for roughly 50% of prevalent infections. Targeted prevention programs offering both needle exchange programs and opiate substitution therapies are urgently called for to prevent the further spread of HIV and HCV in Tajikistan.

Introduction

The HIV epidemic in Central Asia, generally considered to be in a concentrated stage, has been principally fueled by injection drug use, an efficient mode of HIV transmission in the absence of effective prevention.[1] Despite a low number of reported HIV cases in Central Asia, the growth rate of the epidemic from approximately 500 cases in the year 2000 to over 12,000 cases in 2004 signals an alarming trend.[1] Focal outbreaks of HIV in injecting drug user (IDU) populations have recently been reported throughout the region.[2–7]

Data on the epidemiology of HIV in the former Soviet republic of Tajikistan are sparse. Tajikistan is the northern neighbor of Afghanistan and western neighbor of Uzbekistan; it abuts Kyrgystan on its northern border and China to the west (Fig. 1). Although data on HIV prevalence are lacking from Afghanistan, Uzbekistan and China are facing serious HIV epidemics.[8,9] As of March 2004, 170 cases of HIV infection had been registered in Tajikistan. In 2004, UNAIDS estimated the total number of people living with HIV/AIDS as less than 200–400 individuals and the rate of adult HIV infection as less than 0.1–0.2%.[10,11] Almost 75% of reported cases have been attributed to injecting drug use. Available data suggest that in Dushanbe, the capital city of Tajikistan, the prevalence of HIV among IDUs was 3.85% in 2001.[10,11] Needle sharing behaviors in Dushanbe are

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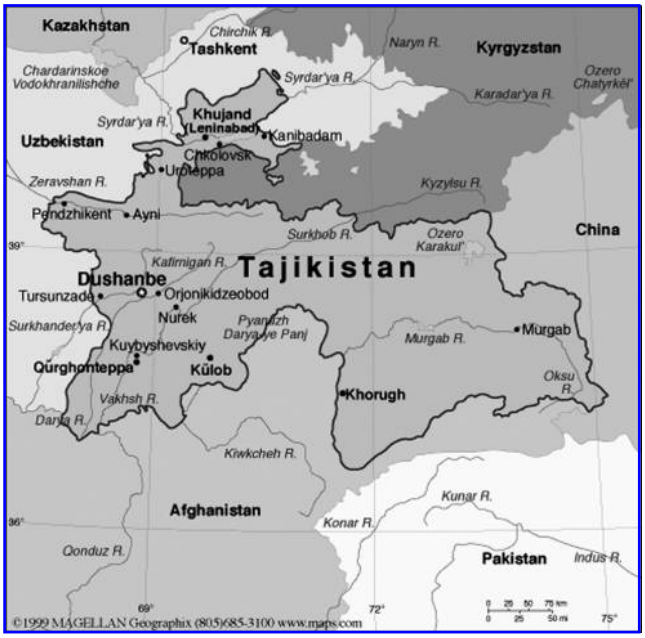

FIG. 1. Map of Tajikistan.

ubiquitous; almost 95% of IDUs report sharing syringes and needles.

Although Tajikistan has few reported HIV/AIDS cases, the official data almost certainly do not accurately reflect the current epidemic situation. Tajikistan, one of the poorest countries in the region, has been unable to support adequate diagnostic facilities and efficient surveillance systems. Only recently have improved laboratory diagnostics for HIV appeared due to support from the Global Fund to fight AIDS, Tuberculosis, and Malaria beginning in 2003.[11] As evidence of this, the number of registered HIV cases in Tajikistan doubled in 2003, and in the first month of 2004 alone the number of registered cases increased by more than 25%. In addition to inadequate testing facilities and surveillance systems, few epidemiologic data exist on HIV and HCV prevalence, risks and behaviors in Tajikistan.

As a frontline transit state for opium and heroin produced in Afghanistan, Tajikistan faces a serious epidemic of opiate use. In 2006, opium production in Afghanistan increased almost 50% causing global opiate production to reach a new record high.[12] Of the world's heroin, 92% now comes from poppies grown in Afghanistan. Approximately 20% of Afghan heroin produced is estimated to leave Afghanistan to the North though Central Asia toward the Russian Federation, and based on narcotics seizure figures, Tajikistan is believed to be the primary trafficking country for heroin exiting on this route. Mounting evidence indicates that injecting drug use and HIV infection follow overland heroin trafficking routes.[13,14] Opiate consumption is rapidly increasing in countries surrounding Afghanistan; the UNODC estimates the total number of opiate users in Central Asia is close to 300,000 persons, with anywhere from 30% to 50% being IDUs.[7,12,15] The culture of fear surrounding drug use in Tajikistan compounds the drug use epidemic. Tajikistan continues to have a poor human rights record, and these human rights violations may aid and abet the spread of HIV.[16–18] Drug users face possible arrest for possession of syringes and often face arrest and persecution from police when trying to access services.

Central Asia is in danger of an explosive HIV crisis. Implementing programs to prevent the spread of HIV in IDU populations will likely prove vital in preventing further spread to noninjecting populations, initially the sexual partners of IDUs, that can serve as "bridge" populations, as has been documented in China, Northeast India, and Thailand. Epidemiologic studies are an urgent priority for understanding HIV and HCV transmission risks in Tajikistan, and for identifying appropriate prevention targets and strategies. From May to November 2004 we recruited 491 IDUs in Dushanbe, Tajikistan in a community-based study. We investigated the prevalence of HIV, HCV, and syphilis, HIV-1 molecular subtypes, and risk behaviors among the recruited drug users. We have previously reported on the marked ethnic differences in HIV prevalence and risks among this cohort.[19] We now report on the risks for HCV, HIV, and on the molecular epidemiology of HIV-1 in this cohort. This is the first in-depth epidemiologic study assessing HIV molecular and HCV risks among IDUs in Tajikistan.

Materials and Methods

Study population

Dushanbe is the capital of Tajikistan and the country's largest city, with a population at the last available census of approximately 530,000 persons.[20] The city is ethnically mixed with Tajik, Uzbek, Russian, Tatar, and Kyrgyz groups. While drug treatment with substitution therapy remains unavailable in Dushanbe, there are several needle exchange programs (NEPs), supported by NGOs, including the Open Society Institute Tajik Program, that are tolerated by the authorities. NGO outreach workers are also active in visiting shooting galleries, which are generally in private apartments, and engaging in needle and syringe exchange and preventive education.

Recruitment for this community-based study occurred from May to November 2004 in Dushanbe, Tajikistan. Eligible study participants were 17 years of age and over, active IDUs (injection within the previous month), Russian and/or Tajik speaking, and able to provide informed consent. Trained outreach workers with experience working with local NEPs recruited participants from the community at shooting galleries, private apartments, and local NEP sites. Snowball recruitment techniques were used to achieve the desired sample size for risk factor analysis. Training for the study staff was conducted in Moscow by AIDS Infoshare and Johns Hopkins University faculty. Study staff were trained in conducting pre- and post-HIV test counseling, research ethics, interviewing skills, informed consent procedures, outreach and recruitment strategies, and data management. Interviews were conducted at an urban polyclinic with a large and diverse patient population to minimize the risk of participant identification. The response rate for the survey was 86%. A personal hygiene package worth approximately 10 U.S, dollars was provided to each participant.

Prior to initiation of the study ethics approval was granted by the Committee on Human Research at the Johns Hopkins Bloomberg School of Public Health as well by the Institutional Review Board of the Ministry of Health of Tajikistan, which

holds a Federal Wide Assurance from the U.S. Office of Human Research Protection (FWA00005370). This project was conducted in collaboration with the Tajikistan Open Society Institute and AIDS infoshare, a Russian-based NGO. Both organizations have a strong human rights focus as well as extensive involvement in HIV/AIDS prevention activities in the region and consequently have managed to establish strong collaborative links with government, public institutions, and civil society.

Data collection

After obtaining written informed consent, a trained staff member conducted an interview, lasting approximately 30–45 min, in either Tajik or Russian. The final instrument used in the interview was developed from instruments used with IDUs in other settings, data obtained during formative qualitative interviews of IDUs, and feedback received after pretesting conducted with 25 IDUs. The questionnaire contained information about demographics, drug use and sexual risk behaviors, general health status, and knowledge of HIV and HCV.

Laboratory techniques

Screening for HIV antibody was conducted using the OraQuick Rapid HIV-1 Antibody test (Abbot Laboratories, Abbott Park, IL). Specimens that tested positive were confirmed by ELISA, CombiBest AntiHIV-1 + 2 (VektorBest Ltd., Novosibirsk, Russia) at the Federal Virology Laboratory of the Tajik Scientific and Research Institute of Prevention Medicine. In addition, 20 specimens were validated for HIV positivity using RNA-based assays at the Henry M. Jackson Foundation laboratory in Rockville, MD. Screening for HCV antibody was carried out with the BIOELISA HCV kit for qualitative detection. Sera were screened for syphilis using rapid plasma reagent (RPR) assays (LUES). Positive results were confirmed with passive hemagglutination reaction (PHAR) assays (LUES-PHAR). Genetic sequence analysis of a partial pol amplicon from PBMC DNA was completed on samples with sufficient volumes at the Henry M. Jackson Foundation Laboratory in Rockville, MD as described elsewhere.[21]

Statistical analysis

The primary outcome variables in this study were HIV status and HCV antibody status. Univariate analysis was performed using Pearson's chi-square and logistic regression models to generate odds ratios with 95% confidence intervals. Separate multivariate logistic regression models were constructed for HIV and HCV infection; all covariates found to be significant ($p < 0.05$) or near significant at the univariate level were considered for inclusion into these models as were other important variables or potential confounders. Multicollinearity between variables in the logistic regression models was determined to be minor. For variables with excessive missing data, an indicator variable for "missing" was introduced into the model. To determine variables that were most significant in predicting HIV and HCV status, full models were reduced using manual backward stepwise logistic regression, forcing gender and ethnicity into the model. Ethnicity was controlled for in the multivariate analysis for HIV and HCV infection risks, as we have reported on ethnicity and HIV in a separate report, and it was found to be an important infection risk for HIV.[19] We assessed model fit using the Hosmer and Lemeshow and Pearson's goodness-of-fit tests. All analyses were conducted using the statistical program STATA Version 8.0 (STATA, College Station, TX).

Results

Sample characteristics

Of the 491 IDUs studied, the majority of individuals were male (84.7%) and the median age was 31 years [interquartile range (IQR): 26–39] (Table 1). Almost half (49.1%) were ethnic Tajik, 29.7% were Russian, 11.9% Uzbek, and 9.4% of other ethnicity. Most (80%) were unemployed and almost two-thirds received less than 10 years of education. Nearly one-third (30.2%) reported living or working outside of Tajikistan in the past 10 years and 54.7% reported a history of army service. A history of arrest was common (reported by 44.5%). Few reported a prior history of HIV testing (14.9%, $n = 60$) or HCV testing (4.1%, $n = 12$) (data not shown).

Of the 488 individuals who provided a sufficient blood specimen for HIV antibody testing, 59 (12.1%) were HIV positive; of the 491 individuals tested for HCV antibody, 301 (61.3%) were HCV positive. As expected, coinfection was common; only one HIV-positive individual was not HCV positive. The prevalence of syphilis was high at 15.7%. Among 20 HIV-positive IDUs with sufficient specimens available for typing, three variants were identified: 10 samples (50%) were found to be subtype A (former Soviet Union, FSU), 9 samples (45%) were CRF02_AG, a circulating recombinant form common in West and West Central Africa, and the remaining sample ($n = 1$, 5%) was a unique recombinant formed from CRF02_AG and subtype A (FSU).

Injecting drug use was ascertained through self-report and physical examination of the participants. The drug of choice was heroin, with 98.8% reporting a history of injecting heroin. In addition to heroin, a lifetime history of injecting cocaine ($n = 4$), homemade opiates (vint, hanka, etc.) ($n = 10$), and synthetic opiates ($n = 8$) was reported. Other forms of drug use were also common: 65.4% reported a history of smoking heroin and over 42% reported alcohol consumption two to three times per week or more; 15% reported daily alcohol consumption. Opium smoking was relatively uncommon; only 17.6% reported a history of smoking opium (data not shown). The median age at initiation of injecting drugs was 24 years (IQR: 20–30) (Table 2); 39.1% reported injecting on a daily basis in the past 6 months. The median duration of drug use in our sample was 5 years (IQR: 2–9 years). The lifetime prevalence of injecting with a used needle was 47.2%. Almost two-thirds (64.5%) reported always using a sterile or new needle in the past 6 months but only 40% reported having ever received a needle from an NEP. Approximately half (49.9%) reported sharing a used syringe with someone else since they began injecting narcotics. The proportion that reported injecting drugs while in the army was 27% (data not shown). Tattooing was a fairly common practice; 35.9% reported having a tattoo. Over one-third (37.9%) reported a history of drug treatment, which consisted mainly of outpatient or inpatient detoxification.

Table 1. Baseline Characteristics and HIV and HCV Prevalence among Tajik IDUs in Dushanbe, Tajikistan, 2004

Variable	*Total (%)*	*HIV positive (%)*	*OR (95% CI)*	*HCV positive (%)*	*OR (95% CI)*
Gender ($n=490$)					
Male	415 (84.7)	51 (12.4)	1.00	270 (65.1)	1.00
Female	75 (15.3)	8 (10.7)	0.85 (0.38–1.86)	31 (41.3)	0.38 (0.23–0.63)
Age ($n=485$)					
<25	109 (22.5)	8 (7.3)	1.00	54 (49.5)	1.00
25–29	100 (20.6)	16 (16.0)	2.41 (0.97–5.97)	70 (70.0)	2.38 (1.33–4.26)
30–39	162 (33.4)	29 (17.9)	2.75 (1.19–6.33)	113 (69.8)	2.35 (1.40–3.93)
40+	114 (23.5)	6 (5.3)	0.69 (0.23–2.08)	61 (53.5)	1.17 (0.69–1.99)
Employment ($n=491$)					
Employed	98 (20.0)	8 (8.2)	0.61 (0.28–1.33)	68 (69.4)	1.56 (0.97–2.51)
Unemployed	393 (80.0)	51 (13.0)	1.00	233 (59.3)	1.00
Education ($n=488$)					
≤10 years	315 (64.5)	45 (14.3)	1.00	194 (61.6)	1.00
Post-Secondary	173 (35.5)	14 (8.1)	0.53 (0.28–1.00)	106 (61.3)	0.99 (0.67–1.44)
Marital status ($n=470$)					
Unmarried	215 (45.7)	22 (10.2)	1.00	132 (61.4)	1.00
Married	140 (29.8)	22 (15.7)	1.61 (0.85–3.04)	99 (70.7)	1.52 (0.96–2.40)
Divorced	115 (24.5)	15 (13.0)	1.30 (0.64–2.61)	60 (52.2)	0.69 (0.43–1.08)
Nationality ($n=489$)					
Russian	145 (29.7)	5 (3.5)	1.00	74 (51.0)	1.00
Tajik	240 (49.1)	46 (19.2)	6.71 (2.53–17.78)	161 (67.1)	1.96 (1.27–3.00)
Uzbek	58 (11.9)	2 (3.5)	1.02 (0.19–5.43)	37 (63.8)	1.69 (0.90–3.18)
Other	46 (9.4)	6 (13.0)	4.20 (1.19–14.82)	28 (60.9)	1.49(0.76–2.95)
Religion ($n=466$)					
Muslim	300 (64.4)	50 (16.7)	1.00	201 (67.0)	1.00
Christian	154 (33.0)	7 (4.6)	0.24 (0.10–0.54)	82 (53.3)	0.56 (0.38–0.84)
Other	12 (2.6)	1 (8.3)	0.45 (0.056–3.58)	8 (66.7)	0.99 (0.29–3.36)
Army service ($n=464$)					
No	210 (45.3)	27 (12.9)	1.00	130 (61.9)	1.00
Yes	254 (54.7)	31 (12.2)	0.95 (0.54–1.64)	159 (62.6)	1.03 (0.71–1.50)
Ever arrested ($n=476$)					
No	264 (55.5)	31 (11.7)	1.00	141 (53.4)	1.00
Yes	212 (44.5)	25 (11.8)	1.00 (0.57–1.76)	150 (70.8)	2.11 (1.43–3.11)
Spent time in prison ($n=157$)					
No	36 (22.9)	5 (13.9)	1.00	24 (66.7)	1.00
Yes	121 (77.1)	14 (11.6)	0.82 (0.27–2.46)	100 (82.6)	2.38 (1.02–5.58)
Spent time in a detention center ($n=143$)					
No	28 (19.6)	3 (10.7)	1.00	15 (53.6)	1.00
Yes	115 (80.4)	14 (12.2)	1.17 (0.31–4.40)	96 (83.5)	4.38 (1.72–11.1)
Lived/worked outside Tajikistan in past 10 years ($n=477$)					
No	333 (69.8)	35 (10.5)	1.00	188 (56.5)	1.00
Yes	144 (30.2)	24 (16.7)	1.69 (0.96–2.96)	112 (77.8)	2.70 (1.71–4.27)

Approximately half (52.2%) reported having their first sexual encounter at 16 years of age or younger (Table 3). The median number of lifetime sexual partners of the opposite sex was 10 partners (IQR: 4–25), while the median number of sexual partners of the opposite sex in the past 6 months was 2 (IQR: 1–4). Reported condom use at last sexual encounter was uncommon, with only 26.6% of individuals reporting this behavior. Overall, one-fifth (21.1%) reported having traded sex for drugs or money; among females, this proportion was 77%. The proportion of males reporting sex with other males was 5.3%.

HIV

Being of Tajik nationality was associated with significantly higher odds of HIV infection as compared to being of Russian nationality, as previously reported (OR 6.71, 95% CI 2.53–17.78). Injecting every day as compared to injecting once a week or less was associated with being HIV positive (OR 3.04, 95% 1.28–20). Receiving a needle from an NEP was inversely associated with HIV infection (OR 0.52, 95% CI 0.28–0.96). However, a history of receiving drug abuse treatment was associated with a 4.89 times higher odds of HIV infection (95% CI 2.63–9.08). Among individuals with regular sexual partners in the past 6 months, reporting never using condoms with regular partners was associated with higher odds of HIV (OR 4.28, 95% CI 1.26–14.52). Reporting greater than five sexual partners as compared to no or one sexual partner in the past 6 months was inversely associated with HIV (OR: 0.19, 95% CI 0.04–0.84). This relationship is likely the result of confounding; the association was no longer significant when adjusted for condom use with casual sexual partners in the past 6 months or nationality (data not shown). There was no association between HIV and history of trading sex for drugs or money or paying for sex with drugs or money. Among the 21 men reporting a lifetime

Table 2. Injection Behaviors and HIV and HCV Prevalence among Tajik IDUs in Dushanbe, Tajikistan, 2004

Variable	*Total (%)*	*HIV positive (%)*	*OR (95% CI) HIV positive*	*HCV positive (%)*	*OR (95% CI) HCV positive*
Age at initiation of injection ($n = 481$)					
<20 years old	117 (24.3)	7 (6.0)	1.00	69 (69.0)	1.00
20–30 years old	245 (50.9)	40 (16.3)	3.07 (1.32–7.15)	168 (68.6)	1.52 (0.96–2.40)
>30 years old	119 (24.7)	12 (10.1)	1.75 (0.66–4.63)	57 (47.9)	0.64 (0.38–1.07)
Years since initiating injecting ($n = 473$)					
<2 years	78 (16.5)	6 (7.7)	1.00	36 (46.2)	1.00
2–5 years	194 (41.0)	30 (15.5)	2.22 (0.88–5.61)	123 (63.4)	2.02 (1.18–3.47)
>5 years	201(42.5)	22 (11.0)	1.48 (0.58–3.82)	131 (65.2)	2.18 (1.27–3.75)
Injecting with a used needle—lifetime ($n = 489$)					
Never	258 (52.8)	28 (10.9)	1.00	137 (53.1)	1.00
Ever	231 (47.2)	31 (13.4)	1.27 (0.73–2.19)	162 (70.1)	2.07 (1.42–3.03)
Use of sterile/new needle in the past 6 months ($n = 482$)					
Not always	171 (35.5)	24 (14.0)	1.00	124 (72.5)	1.00
Always	311 (64.5)	34 (10.9)	0.74 (0.42–1.30)	171 (55.0)	0.46 (0.31–0.70)
Ever received a needle from NEP ($n = 487$)					
No	292 (60.0)	43 (14.7)	1.00	191 (65.4)	1.00
Yes	195 (40.0)	16 (8.2)	0.52 (0.28–0.96)	107 (54.9)	0.64 (0.44–0.93)
Frequency of injection in the past 6 months ($n = 488$)					
Once a week or less	99 (20.3)	7 (7.1)	1.00	56 (56.6)	1.00
2–6 times/week	198 (40.6)	15 (7.6)	1.07 (0.42–2.72)	98 (49.5)	0.75 (0.46–1.22)
Everyday	191 (39.1)	36 (18.9)	3.04 (1.28–7.20)	145 (75.9)	2.42 (1.43–4.11)
Injections per needle in past 6 months ($n = 462$)					
One or less	222 (48.1)	19 (8.6)	1.00	111 (50.0)	1.00
Two	106 (22.9)	16 (15.1)	1.92 (0.94–3.93)	72 (67.9)	2.12 (1.29–3.47)
Greater than two	134 (29.0)	20 (14.9)	1.89 (0.96–3.71)	99 (73.9)	2.83 (1.75–4.57)
Group vs. alone narcotic use in past 6 months ($n = 487$)					
Alone	266 (54.6)	37 (13.9)	1.00	158 (59.4)	1.00
Group	221 (45.4)	21 (9.5)	0.65 (0.37–1.16)	140 (63.4)	1.18 (0.82–1.71)
Received drug tx ($n = 491$)					
No	305 (62.1)	17 (5.6)	1.00	164 (53.8)	1.00
Yes	186 (37.9)	42 (22.6)	4.89 (2.63–9.08)	137 (73.7)	2.40 (1.60–3.60)
Number of times gone through drug tx ($n = 488$)					
Never	305 (62.5)	17 (5.6)	1.00	164 (53.8)	1.00
1–2 times	127 (26.0)	28 (22.0)	4.74 (2.44–9.22)	81 (63.8)	1.51 (0.99–2.32)
Greater than 2 times	56 (11.5)	14 (25.0)	5.59 (2.50–12.5)	53 (94.6)	15.2 (4.38–52.7)
Tattoo ($n = 490$)					
No	314 (64.1)	44 (14.0)	1.00	180 (57.3)	1.00
Yes	176 (35.9)	15 (8.5)	0.57 (0.31–1.06)	121 (68.8)	1.64 (1.11–2.42)
Transfusion ($n = 489$)					
No	456 (93.3)	57 (12.5)	1.00	279 (61.2)	1.00
Yes	33 (6.8)	2 (6.1)	0.45 (0.10–1.93)	21 (63.6)	1.11 (0.53–2.31)

history of sex with men there were no HIV-positive individuals.

In the final stepwise selection model adjusted for gender ($n = 419$), Tajik nationality (OR 7.06, $p < 0.001$, reference group: Russian nationality) and other nationality (OR 6.05, $p = 0.009$) as well as daily injection in the past 6 months as compared to injection less than once a day (OR 3.22, $p < 0.001$) remained independently associated with HIV status (data not shown).

HCV

Females had significantly lower odds of HCV positivity than males (OR 0.38, 95% CI 0.23–0.63). Individuals of Tajik nationality had an elevated odds of HCV positivity (OR 1.96, 95% CI 1.27–3.00) compared to those of Russian nationality. Having lived or worked outside Tajikistan in the past 10 years was associated with higher odds of HCV (OR 2.70, 95% CI 1.71–4.27). Positive HCV status was also associated with a reported history of arrest (OR 2.11, 95% CI 1.43–3.11), spending time in prison (OR 2.38, 95% CI 1.02–5.58), and spending time in a detention center (OR 4.38, 95% CI 1.72-11.1). Reporting a history of injecting drug use in prison or detention centers was not associated with being HCV positive, nor was the reported use of a used syringe in these settings (data not shown).

Those who reported a history of injecting with a used syringe in their lifetime had a 2.07 times higher odds of HCV (95% CI 1.42–3.03), while always using a sterile or new syringe in the past 6 months was protective for HCV (OR 0.46, 95% CI 0.31–0.70). Receiving a syringe from an NEP was also protective for HCV (OR 0.64, 95% CI 0.44–0.93). Individuals who reported having a tattoo were more likely to be HCV positive (OR 1.64, 95% CI 1.11–2.42). Individuals who received drug treatment had higher odds of HCV (OR 2.40, 95% CI 1.60–3.60).

Table 3. Sexual Behaviors and HIV Prevalence among Tajik IDUs in Dushanbe, Tajikistan, 2004

Variable	*Total (%)*	*HIV positive (%)*	*OR (95% CI) HIV positive*
Trading sex drug/money ($n=445$)			
No	351 (78.9)	45 (12.8)	1.00
Yes	94 (21.1)	8 (8.5)	0.64 (0.29–1.41)
Condom use: regular sexual partners in past 6 months ($n=330$)			
Sometimes	246 (74.5)	34 (13.8)	1.00
Never	84 (25.5)	3 (3.6)	4.28 (1.26–14.52)
Condom use: casual sexual partners in past 6 months ($n=245$)			
Sometimes	122 (49.8)	14 (11.5)	1.00
Never	123 (50.2)	9 (7.3)	1.64 (0.68–3.97)
Condom at last sexual contact ($n=410$)			
Yes	301 (73.4)	30 (10.0)	1.00
No	109 (26.6)	13 (11.9)	0.81 (0.41–1.62)
MSM (ever) ($n=397$)			
No	376 (94.7)	48 (12.8)	1.00
Yes	21 (5.3)	0	—
Paying for sex with drug/money ($n=445$)			
No	352 (79.1)	45 (12.8)	1.00
Yes	93 (20.9)	8 (8.6)	0.65 (0.29–1.43)
Ever STI ($n=488$)			
No	387 (79.3)	52 (13.4)	1.00
Yes	101 (20.7)	7 (6.9)	0.48 (0.21–1.09)
Age at first sexual contact ($n=464$)			
≤16 years	242 (52.2)	27 (11.2)	1.00
>16 years	222 (47.8)	28 (12.6)	1.14 (0.65–2.01)
Number of sexual partners in past 6 months ($n=451$)			
0–1	225 (49.9)	29 (12.9)	1.00
2–5	153 (33.9)	23 (15.0)	1.20 (0.66–2.17)
>5	73 (16.2)	2 (2.7)	0.19 (0.04–0.84)

In the final stepwise selection model, Tajik nationality (OR 1.91, $p=0.013$), daily injection of narcotics (OR 3.26, $p<0.001$), having lived or worked outside Tajikistan in the past 10 years (OR 2.43, $p=0.001$), and a history of arrest (OR 2.37, $p<0.001$) remained significant predictors of HCV, whereas a history of always using a sterile or new syringe (OR 0.47, $p=0.001$) and female gender (OR 0.53, $p=0.045$) remained negatively associated with HCV (Table 4).

Syphilis

Only two variables were significantly associated with positive syphilis status in the univariate analysis; female gender (OR 2.49, 95%CI 1.40–4.44) and a history of arrest (OR 1.67, 95% CI 1.02–2.75). Over one-quarter (28%) of women in the sample tested positive for syphilis compared to 13.5% of men (data not shown).

Discussion

This is the first in-depth epidemiologic study assessing HIV and HCV prevalence and correlates and HIV molecular subtypes among IDUs in Tajikistan. Our study revealed an HIV prevalence of 12.1% among IDUs in Dushanbe, which substantially exceeds a previous estimate and suggests that the HIV epidemic in this population is in a concentrated rather than nascent stage.[10] The prevalence of HCV infection in this cohort was 61.3%, indicating that multiperson use of syringes and injection paraphernalia is common in this population.

Table 4. Multivariate Logistic Regression of Risk Factors Independently Associated with HCV among IDUs in Dushanbe, Tajikistan ($N=434$)

Variable	*Odds ratio HCV positive*	*Confidence interval*	p-*value*
Daily injection of narcotics[a]	3.26	2.04–5.21	<0.001
Lived or worked outside Tajikistan in the past 10 years	2.43	1.46–4.03	0.001
Always using a sterile syringe in the past 6 months	0.47	0.30–0.74	0.001
Female[b]	0.53	0.28–0.99	0.045
Tajik nationality[c]	1.91	1.15–3.19	0.013
Ever arrested	2.37	1.50–3.72	<0.001

[a]Reference group: injection less than once a day.
[b]Reference group: male.
[c]Reference group: Russian nationality.

Fifty percent of the HIV-infected individuals sequenced were found to be subtype FSU-A, the strain most commonly found in the FSU. Another 45% of the HIV-infected subset sampled was infected with CRF02_AG, a recombinant common in West and West Central Africa, and the dominant HIV-1 variant in Nigeria and Côte d'Ivoire. The CRF02_AG strains found in our study were monophyletic, with low genetic diversity, and so were likely descended from a common ancestor. CRF02_AG has also been found in the neighboring Central Asian countries of Uzbekistan, Kazakhstan, and Kyrgyzstan and the Tajik strains clustered with those found in these countries.[22–24] One strain was a unique recombinant between CRF02_AG and subtype A. The close genetic relationship of this Tajik unique recombinant to the Tajik CRF02_AG and the subtype A strains suggests local formation of this unique recombinant.

The interconnectedness between transmission networks can be revealed through genetic analysis of HIV. The CRF02_AG strain and the FSU-A strain may represent molecular markers for two different drug-using networks in Dushanbe, Tajikistan. Also, the presence of a unique recombinant of CRF02_AG and FSU-A suggests that these two drug networks may have overlapped to some extent. Molecular subtyping of HIV-1 strains is a useful tool for understanding heroin trafficking routes and HIV spread across national borders. In the trafficking zones around Burma subtypes B, C, E, and two different B/C recombinants have been found, and the patterns of their spread have helped describe both HIV dynamics and heroin trafficking.[13,14] The location of origin and the direction of spread of the West African CRF02_AG strain in Central Asia require further study. Trafficking routes in this region should be monitored carefully as they may provide important information on the spread of the CRF02_AG subtype in the region. Afghan opiates have supplied the markets of neighboring countries, Europe, the Near and Middle East, and Africa.[12] According to UNODC, Africa is increasingly being exploited by drug traffickers. East Africa, particularly Kenya, Mozambique, and Tanzania, has reported large increases in heroin abuse in recent years and an increase

in opiate abuse has also been reported by South Africa and a number of countries in West Africa. These increases are very likely linked to greater amounts of heroin transiting these regions.

Tajikistan experiences marked labor migration; an estimated 1.5 million people in Tajikistan go abroad for seasonal work, frequently into the Russian federation.[18] These migrant workers, subject to both IDU and sexual risks while in Russia, risk importing infection into their home country when they return. In our study, individuals who reported living or working outside Tajikistan in the past 10 years had significantly higher HCV prevalence and migration proved to be independently associated with HCV infection after adjusting for known HCV risk factors. The association of HCV with migration outside Tajikistan in the past 10 years likely reflects risky injection practices in this context and indicates the need for focused educational efforts among migrant workers.

Along with rapid HIV spread among IDUs, Central Asia faces concurrent epidemics of sexually transmitted infections (STIs). The prevalence of syphilis among our IDU sample was 15.7% and female IDUs were more than twice as likely to have evidence of syphilis infection compared to males. The high prevalence of syphilis among female IDUs may reflect their involvement in commercial sex work, since 75% of the women in our study reported a history of trading sex for drugs or money. The high prevalence of syphilis we observed is concerning as untreated ulcerative STIs are known to enhance HIV acquisition and transmission.

An unanticipated finding was the association between both HIV and HCV infection and a history of receiving drug treatment. Prevalence of HIV among individuals who had received drug treatment approached five times that of individuals not reporting treatment and for HCV, there was an approximate 2.5-fold increase in prevalence among those reporting a history of drug treatment. In the case of HCV, this appeared to be related to the number of times an individual reported receiving drug treatment; individuals reporting treatment on greater than two occasions compared to those never receiving treatment had a 15 times higher odds of HCV, whereas those receiving treatment only one or two times did not have a statistically significant higher odds of HCV as compared to those never receiving treatment. Individuals who underwent drug treatment more than two times are likely to be an especially risky subgroup. One possible explanation for this finding is that the subgroup of IDUs who sought drug treatment represent those IDUs who are more seriously addicted, among whom drug treatment may be a marker of high-risk injection behavior. We were able to confirm that those IDUs with a longer duration of drug use, and therefore more likely to be seriously addicted, were significantly more likely to have undergone drug treatment (data not shown). Another possible explanation stems from the nature of drug treatment in Tajikistan, which at present does not involve substitution therapy and supportive services and is most often an involuntary, institutionalized process. Access to sterile injection equipment would be limited in this setting, possibly resulting in increased needle sharing behavior.

Given the current concentrated HIV epidemic among IDUs in Dushanbe, it is vital that prevention programs be implemented to prevent the further spread of HIV among IDUs and subsequent sexual transmission to "bridge" populations in Tajikistan. Effective control of an HIV epidemic concentrated within IDUs requires that drug users have safe access to appropriate preventive services that offer NEPs. There is considerable evidence that NEPs lead to a reduction in HIV incidence among IDUs and successful NEPs have been conducted in Australia, the Netherlands, the United Kingdom, and Northern Ireland.[25,26] Of particular importance in our study was the finding that those who reported always using a sterile needle in the past 6 months had a significantly lower prevalence of HCV, lending further support to the widespread implementation of NEPs in Tajikistan. Preventive services offered to IDUs should also provide access to opioid agonist therapies in the form of methadone and/or buprenorphine. Opiate agonist treatments having been shown to be cost effective and are associated with reductions in the frequency of opioid use, fewer injections and injection-related HIV risk behaviors, and lower rates of HIV prevalence and incidence.[25,27,28]

Two important limitations of this study are its cross-sectional nature and the reliance on self-reported data for behavioral risk factors. Although we believe that our study population was representative of urban IDUs in Dushanbe, since initial recruitment for the survey occurred in needle and syringe exchange programs and shooting galleries we may have oversampled a higher risk subset of IDUs more likely to use these services. Furthermore, as we were only able to genotype 20 of the 59 HIV-positive specimens, we are limited in our ability to generalize the molecular subtype results to all IDUs in Dushanbe. Finally, the results from our study may not be generalizable to Tajik IDU populations outside Dushanbe, the largest and most urban city in Tajikistan. Although a sizable proportion of Tajik IDUs live in Dushanbe, Tajikistan is a predominantly rural country; as of 2006 only 26% of the population was urbanized.[20] IDU populations in Tajikistan may differ considerably from one another in important factors such as ethnic and socioeconomic composition as well as access to drugs and sterile injection equipment.

Tajikistan's HIV epidemic has unfolded in a complicated milieu of increasing injecting drug use, political instability, human rights concerns, rapid social change, high unemployment and labor migration, as well as the country's position as a frontline state for the trafficking of Afghan heroin. Urgent action in the form of prevention programs offering both NEPs and opiate agonist therapies is required to prevent further spread of HIV, HCV, and STIs in IDU populations in Tajikistan and the subsequent spread to wider sexual transmission risk groups and populations.

Acknowledgments

This research was supported in part by a grant from the U.S. Agency for International Development Central Asia Region (USAID/CAR) and by the Fogarty International Center (2 D 43 TW000010-18-AITRP).

Disclosure Statement

No competing financial interests exist.

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