

Hepatitis C and HIV Prevalence Using Oral Mucosal Transudate, and Reported Drug Use and Sexual Behaviours of Youth in Custody in British Columbia

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ABSTRACT

Background: Youth in custody have high-risk drug use and sexual behaviours. HIV prevalence in this population was assessed in British Columbia (BC) in 1994 but hepatitis C virus (HCV) prevalence has never been measured. We sought to determine: 1) the performance of the OraSure[®], a non-invasive device for oral mucosal transudate (OMT) specimen collection, to detect HCV and HIV antibodies; 2) the prevalence of HCV and HIV among youth in custody; and 3) the factors associated with intravenous drug use and sex for trade.

Methods: OraSure[®] was validated in 110 adults with known HIV and HCV sero-status. Nurses administered an anonymous survey and collected OMT samples from youth aged 14-19 years in BC youth custody centres.

Results: Antibody detection in OMT had 96.4% sensitivity for HIV and 94.6% for HCV. 417 youth were enrolled; 22% were female; 48% reported Aboriginal ethnicity. Although 98.3% reported ever using drugs, <8% reported injection drug use (IDU). IDU was independently associated with age of first sexual intercourse (inverse association) and sex for trade (sex in exchange for money, drugs, food or shelter) (OR 4.28; 95% CI: 1.56-11.75). Females were >9 times more likely to report sex for trade. Five Aboriginal youth were identified with HCV; prevalence estimate 1.2% (95% CI: 0.53-2.77%); 3 reported injecting drugs, the other 2 reported using cocaine/crack and sharing non-injection drug paraphernalia. Two youth were identified with HIV, prevalence estimate 0.48% (95% CI: 0.14%-1.72%).

Conclusion: IDU, HCV and HIV prevalence remain low. Interventions are needed to prevent transition to IDU and further opportunities for prevention and harm reduction should be explored while the youth are in custody.

Key words: HIV; hepatitis C; youth

La traduction du résumé se trouve à la fin de l'article.

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Youth in custody report high-risk drug use and sexual behaviours.¹ The prevalence of HIV in British Columbia youth in custody was assessed in 1994;² hepatitis C virus (HCV) prevalence has never been measured. A recent Ontario study found 1/298 (0.4%) of youth in custody had been HCV-infected and no persons identified with HIV.³ The prevalence of HCV in BC is twice that of Canada.⁴ Therefore we sought to determine HCV and HIV prevalence, and factors associated with intravenous drug use (IDU) and sex for trade among youth in BC custody centres. To increase acceptability of testing, a non-invasive sampling method was utilized. Oral fluid testing using OraSure[®] had been previously validated for HIV antibody testing, but less evidence was available for HCV. Therefore we assessed the performance of OraSure[®] for the detection of HCV and HIV antibodies for prevalence estimations.

BC youth in custody are aged 12-19 years with the majority being 16 or 17. The Youth Criminal Justice Act (2003) encourages moderate sentences and alternatives to imprisonment for less serious crimes. Therefore youth have high rates of short-term confinement; the average stay is <30 days for youth in remand and <60 days for those sentenced. BC has the lowest rate of youth custody admissions in Canada, and youth beds in BC declined from 400 in 1996/7 to 135 in 2004/05.

METHODS

Validation of the OraSure[®] Collection Device

OraSure[®] (Orasure Technologies Inc, Bethlehem, PA) is a non-invasive device for oral mucosal transudate (OMT) specimen collection,

preservation and transportation. The device, a cotton-fibre pad treated with hypertonic salt solution to enhance OMT, is placed between the lower gum and cheek for 2 minutes. Two OMT samples (one from each side of the mouth) and a blood sample, to confirm sero-status, were collected from 110 adults (24 HCV mono-infected, 27 HIV mono-infected, 29 HCV/HIV co-infected and 30 non-infected).

The OMT was collected and extracted according to the manufacturers instructions. Serum and OMT aliquots were stored at -70°C. HIV tests for serum and OMT were performed using the ADVIA Centaur[™] HIV 1/O/2 test (Siemens Medical Solutions Diagnostics, Tarrytown, NY). HIV EIA-reactive OMT were confirmed by Genetic Systems[™] HIV-1 Western blot (Bio-Rad Laboratories, Montreal, QC). HCV tests for serum and initial OMT were performed using the

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Table 1. Demographic and Risk Behaviours of Study Population

	Total	Male	Female	p-value
Number (% known sex)*	417	322 (77.8)	92 (22.2)	
Age (years) mean [SD]	16.2 [1.2]	16.3 [1.2]	16.0 [1.3]	0.03
Ethnicity n (%)				0.18
Non-Aboriginal	201 (48.2)	159 (49.4)	41 (44.6)	
Aboriginal†	201 (48.2)	149 (46.3)	50 (54.3)	
No response	15 (3.6)	14 (4.3)	1 (1.1)	
Location n (%)				<0.01
Burnaby	236 (56.6)	194 (60.2)	42 (45.7)	
Prince George	74 (17.7)	62 (19.3)	12 (13.0)	
Victoria	107 (25.7)	66 (20.5)	38 (41.3)	
Ever been in custody before n (%)				0.12
No	109 (26.1)	78 (24.2)	30 (32.6)	
Yes	281 (67.4)	222 (68.9)	57 (62.0)	
Missing	27 (6.5)	22 (6.8)	5 (5.4)	
Risk behaviour prevalence n (%)				
Non-injection drug use	410 (98.3)	316 (98.1)	91 (98.9)	0.61
Injection drug use	32 (7.7)	18 (5.6)	13 (14.1)	0.01
Used someone else's needle	9 (28.1)	5 (26.3)	4 (33.3)	0.68
Sexual intercourse (ever)	395 (95.0)	303 (94.1)	89 (97.8)	0.16
Sex without condom	287 (73.6)	213 (71.5)	72 (80.9)	0.08
Sex with IDU	45 (13.0)	18 (6.8)	26 (33.3)	<0.01
Sex for trade‡	35 (8.9)	11 (3.7)	24 (26.7)	<0.01
Tattoo	174 (41.7)	126 (39.1)	45 (48.9)	0.09
Piercing	320 (76.7)	228 (70.8)	90 (97.8)	<0.01

* 3 unknown sex
 † Describe ethnicity or family background as First Nations, Metis, or Inuit; participants could give >1 response
 ‡ Sex in exchange for money, drugs, food or shelter

ADVIA Centaur™; all OMT were further analyzed using the Ortho™ HCV 3.0 ELISA SAVe test (Ortho-Clinical Diagnostics, Markham, ON) according to a modified procedure,⁵ which included an increased sample input volume, increased incubation time, and fixed positive cutoff (lower than for serum). All reactive samples were repeated.

Youth study participants

Youth aged 14-19 years, resident in or admitted to the three youth custody centres in BC (Burnaby, Prince George and Victoria) between January and August 2006 and not previously enrolled, were invited to participate in the study. A log was kept of youth who were ineligible due to age, inability to give informed consent (intoxicated or not competent), or unable to speak and/or understand English. Youth who declined to participate or who were missed, i.e., had left the centre before being invited, were recorded. Coloured stickers were used on the custody file to indicate if the youth was invited, missed or ineligible.

Data collection

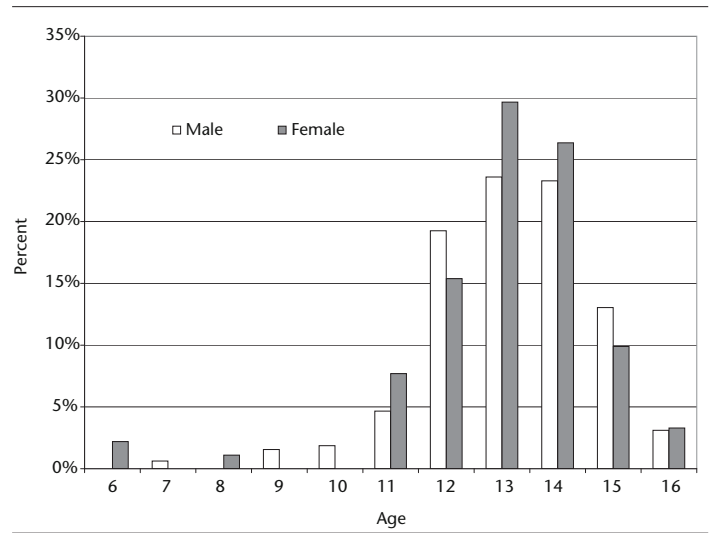
Survey

A survey instrument was developed and piloted following review of questionnaires used in similar populations (Vancouver Injection Drug Users Survey, Ontario remand survey and the Canadian Street Youth Survey). Questions included demographic and social variables, and sexual and substance use behaviours. Nurses at each custody centre were trained to administer the survey and take specimens; a research assistant was employed at the largest site to assist in enrollment. The survey was administered in a private location and participants were informed how to get confidential serum testing and counseling. The survey and clinical samples were anonymous.

Laboratory Procedures

Two OMT samples were collected from each participant. The sample is stable for 21 days at 4-37°C, therefore couriered to the labo-

Figure 1. Reported age at first sex; proportion by gender (males = 322; females = 91)



ratory weekly. The samples were analyzed using ADVIA Centaur for HIV and Ortho HCV 3.0 modified procedure and confirmed as previously described.

Data Analysis

Survey and laboratory data were entered into EpiData and analyzed in SPSS (version 14.0). Demographic and risk behaviour variables were compared by sex using χ^2 test for categorical variables and Mann-Whitney U test for continuous variables. Univariate and multivariate logistic regression analysis were used to examine the association between IDU and sex for trade (sex in exchange for money, drugs, food or shelter) with demographic and risk behaviour variables. Independent variables were kept in the multivariate model if they were significant at 0.25 in univariate analysis. Meaningful interactions and collinearity were checked. Prevalence estimates and 95% confidence intervals (CIs) of HIV and HCV infections were calculated using the exact method based on a binomial distribution.

Ethics approval was received from University of British Columbia Clinical Research Ethics Board for the OraSure® validation and youth in custody study. The study results were shared with staff, nurses, and youth at the custody centres.

RESULTS

OraSure® validation

Of 56 sero-positive HIV patients, 54 were positive on OMT testing by the methods described (sensitivity of 96.4%). However, using the standard ADVIA Centaur HCV assay, only 4 of 22 HCV sero-positive patients' tests were reactive on OMT testing, providing a sensitivity of 18.2%. Using the modified Ortho assay, 53 of 56 HCV sero-positive patients were positive on OMT testing (sensitivity 94.6%).⁵ All sero-negative patients (53 HIV and 52 HCV) were non reactive by OMT testing, giving 100% specificity.

Youth in custody participants

During the study period, 641 individuals were admitted to BC youth custody centres; many had multiple admissions, so those initially missed could be invited at a subsequent admission. Fifty youth declined to participate, 40 were ineligible, 134 youth were

Table 2. Results of Logistic Regression Analysis for Injection Drug Use and Sex for Trade

	Univariate			Multivariate	
	OR	95% CI	p-value	OR	95% CI
Injection drug use					
Age*	1.19	0.88-1.62	0.26		
Female (vs. male)	2.78	1.31-5.91	0.01	1.43	0.58-3.55
Aboriginal (vs. Non-Aboriginal)	0.70	0.34-1.48	0.35		
Custody site (vs. Burnaby)			0.75		
Prince George	0.93	0.33-2.62			
Victoria	1.33	0.59-3.01			
Age of first sexual intercourse*	0.75	0.61-0.91	<0.01	0.76	0.61-0.94
Sex for trade	5.06	2.12-12.04	<0.01	4.28	1.56-11.75
Sex for trade					
Age*	1.06	0.79-1.41	0.72		
Female (vs. male)	9.59	4.47-20.54	<0.01	11.82	4.93-28.35
Aboriginal (vs. Non-Aboriginal)	0.59	0.29-1.22	0.15	0.43	0.18-1.01
Custody site (vs. Burnaby)			0.17		
Prince George	0.29	0.07-1.28		0.20	0.03-1.63
Victoria	1.27	0.60-2.69		0.91	0.38-2.18
Age of first sexual intercourse*	0.84	0.68-1.03	0.10	0.88	0.69-1.12
Injection drug use (vs. no)	5.06	2.12-12.04	<0.01	3.18	1.07-9.40

* The reported values indicate how the odds change for each one-year increase in the variable.

missed and 417 youth (89% of those invited) participated in the study. Gender was missing on 3 surveys; 92 (22%) of the remaining 414 youth were female. Table 1 shows the reported demographic and risk behaviour prevalence.

The majority of youth (72.1%) had previously been in custody, 63.4% were on remand (awaiting court), 199 (48%) participants reported Aboriginal ethnicity (i.e., they described their ethnicity/family background as First Nations, Metis, or Inuit, but they could report more than one). The mean age of participants was 16 with females being slightly younger than males. The majority of youth (56.6%) was enrolled at the Burnaby Centre.

Drug Use

Non-injection drug use was reported by 98.3% of participants; of these, 99.5% reported using marijuana, 83.9% mushrooms, 81.2% Ecstasy, 72.2% powdered cocaine, 60.2% crack, 54.1% crystal methamphetamine, 44.9% Acid, and 20.7% heroin. Thirty-two youth (7.7%) admitted ever injecting drugs; of these, 64.6% reported injecting heroin, 59.4% powdered cocaine, 41.9% morphine, 38.7% crystal methamphetamine and 33.3% speedballs (heroin and cocaine).

On univariate analysis, IDU was associated with: being female (OR 2.78, 95% CI :1.31-5.91), age of first sexual intercourse (the odds decreased by a factor of 0.75 for each year increase in age, 95% CI: 0.61-0.91), and sex for trade (OR 5.06, 95% CI: 2.12-12.04) (Table 2). On multivariate analysis, age of first sexual intercourse (odds decreased by a factor of 0.76 for each year increase of age, 95% CI: 0.61-0.94) and sex for trade (OR 4.28, 95% CI: 1.56-11.75) remained significant. No interactions were found between the independent variables.

Sexual Behaviour

Ninety-five percent of youth reported having vaginal or anal intercourse; age of first sexual intercourse ranged from 6 to 16 years (Figure 1). There was no association between sex and average age of first sexual intercourse. Sex for trade was significantly associated on univariate analysis with being female (OR 9.59, 95% CI: 4.47-20.54) and IDU (OR 5.06, 95% CI: 2.12-12.04); both remained significant on multivariate analysis (Table 2). Unlike in other studies, being Aboriginal was not found to be a risk factor (OR 0.43, 95% CI: 0.18-1.01). No interaction effects were found.

Hepatitis C and HIV Prevalence

Five youth (4 female, 1 male) aged 16-18 years, were identified as having HCV; 3 reported knowing they had HCV and 2 were newly identified by OMT testing. HCV prevalence estimate of the study population was 1.2% (95% CI: 0.53%-2.77%); all 5 were Aboriginal, (prevalence in Aboriginal 2.5% (95% CI: 1.11%-5.71%)). Three admitted IDU with time since first injection 3, 4 and 8 years; both youth who did not report injecting drugs admitted sharing non-injection equipment and using cocaine/crack, and one received piercing and tattooing while in custody.

No youth reported knowing they had HIV. Two non-Aboriginal, non-IDU male youth were identified as HIV-reactive. HIV prevalence estimate was 0.48% (95% CI: 0.14%-1.72%). Neither reported having had sex with a male or having had a sexually transmitted infection in the past, though both admitted sexual activity without a condom. One had received piercing by a non-professional not in custody; the other received a tattoo while in custody.

Dissemination Activities

Study results were presented to the Youth Custody Centre directors, managers and nurses. Most staff reported awareness of the high prevalence of risk behaviours, but were surprised at the low HIV and HCV prevalence. Trained nurses provided feedback to the youth through group sessions and individual teaching opportunities, which raised awareness about the need for testing and about harm reduction and allowed the youth to ask questions.

DISCUSSION

The ADVIA Centaur system had 96.4% sensitivity (without modification) for the detection of HIV antibodies in OMT and, using a modified procedure, the Ortho HCV 3.0 ELISA SAVE had good sensitivity (94.6%) for OMT. Our results are consistent with published literature.⁵ Study participation rate was high (89%) and all participants submitted an OMT sample. As with other non-invasive sampling,⁶ we consider OraSure® collection device to be a highly acceptable method of sample collection in this population.

HCV prevalence was low overall, but significant (2.5%) in Aboriginal youth in custody. We identified a higher point prevalence of both HCV and HIV in BC compared to custodial youth in Ontario (HCV 1.2 vs. 0.4%; HIV 0.48 vs. 0%); we also found a higher preva-

lence of HIV in BC in 2006 compared to 1994 (0.48 vs. 0.25%). However, none of these differences were significant. Our sampling frame differed from other studies in that we included youth in custody at the start of the study period.

Youth reported considerable non-injection drug use, almost all (98%) having ever used marijuana, >80% having ever used mushrooms and Ecstasy, and 72% having used cocaine; however, reported ever use of IDU was <8%. These findings were similar to the 2004 BC youth in custody survey, which found that 80% of youth reported using mushrooms and 80% used cocaine; 11% reported ever injecting an illegal drug.¹

Miller found that early initiation into IDU was associated with being female and incarceration;⁷ another study found the mean age of initiation into IDU was 19 years.⁸ The majority of youth in this study were aged 16 and 17 and so may be at high risk for transition into IDU in the next few years. Independent factors associated with IDU were earlier age of first sexual intercourse and providing sex for trade. As this was a cross-sectional study, no causal or temporal assumptions can be made. Increasing age and Aboriginal ethnicity was not associated with IDU. A study of young (<25 years) IDU found that HCV was associated with Aboriginal ancestry and length of time injecting.⁹ All five HCV-infected youth identified in our study reported Aboriginal ethnicity, and 3/5 admitted injecting drugs for between 3-8 years. The remaining two HCV-infected youth reported using cocaine/crack and sharing drug paraphernalia. Studies have shown HCV may be transmitted by non-injection cocaine administration through sharing straws, and more recently HCV was identified on a crack pipe.¹⁰

Youth providing sex for trade were more likely to be female and to inject. Although other researchers describe Aboriginal youth disproportionately involved in the sex trade,¹¹ this was not found in this study. This may reflect geographic population differences.

CONCLUSIONS

OraSure® collection device is a highly acceptable method of sample collection; testing by ADVIA Centaur for HIV and Ortho HCV 3.0 are satisfactory for prevalence estimations. Non-injection drug use and sexual risk behaviours are widespread in BC youth in custody; however HCV and HIV prevalence and IDU remain low. Time in custody provides an opportunity for preventive and harm reduction interventions, and to connect youth with services on discharge. Interventions are needed that target non-injection drug users to prevent transition to IDU.

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RÉSUMÉ

Contexte : Les jeunes placés sous garde ont des comportements sexuels et d'utilisation de drogues à haut risque. La prévalence du VIH dans cette population a été évaluée en Colombie-Britannique (C.-B.) en 1994, mais la prévalence du virus de l'hépatite C (VHC) n'a jamais été évaluée. Nous avons cherché à déterminer : 1) le rendement d'OraSure®, un appareil non invasif pour le prélèvement du transsudat des muqueuses orales (TMO), afin de détecter les anticorps contre le VHC et le VIH; 2) la prévalence du VHC et du VIH chez les jeunes détenus; et 3) les facteurs associés à l'utilisation de drogues injectables et au commerce du sexe.

Méthode : OraSure® a été validé sur 110 adultes atteints d'une infection du VIH et du VHC. Les infirmières ont effectué des sondages anonymes et ont recueilli des échantillons de TMO chez des jeunes âgés entre 14 et 19 ans dans les centres de détention de la C.-B.

Résultats : La détection d'anticorps dans le TMO avait 96,4 % de sensibilité pour le VIH et 94,6 % pour le VHC. Ainsi, 417 jeunes ont été inscrits; 22 % étaient de sexe féminin; 48 % étaient d'origine autochtone. Bien que 98,3 % affirmaient avoir jamais consommé de drogues, <8 % affirmaient consommer des drogues injectables (DI). L'utilisation de DI était indépendamment associée à l'âge des premiers rapports sexuels (association inverse) et le commerce du sexe (sexe en échange d'argent, de drogues, de nourriture ou d'un abri) (r.c. = 4,28; 95 % i.c. : 1,56-11,75). Les filles étaient >9 fois plus susceptibles d'affirmer se livrer au commerce du sexe. Cinq jeunes Autochtones ont été diagnostiqués atteints du VHC; estimation de la prévalence 1,2 % (95 % i.c. : 0,53-2,77 %); 3 ont affirmé utiliser des DI, les 2 autres affirmaient consommer de la cocaïne/du crack et partager un attirail pour les drogues non injectables. Deux jeunes ont été diagnostiqués atteints du VIH, estimation de la prévalence 0,48 % (95 % i.c. : 0,14 %-1,72 %).

Conclusion : La prévalence de l'utilisation de DI, du VHC et du VIH demeure faible. Des interventions sont requises pour prévenir la transition à l'utilisation de DI, et d'autres possibilités de prévention et de réduction des préjudices devraient être examinées pendant que les jeunes sont détenus.

Mots clés : VIH; hépatite C; jeunes