

and increase LDL size [14], they appear to be a logical option to manage HAART-induced dyslipidemia.

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Determinants of HIV seroconversion in an era of increasing HIV infection among young gay and bisexual men

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Men were followed prospectively to identify demographic and behavioural characteristics associated with HIV seroconversion. Thirty-six HIV cases were identified (HIV incidence 1.9/100 person-years). Unprotected receptive anal sex with HIV-positive partners and with casual partners regardless of serostatus was associated with seroconversion. Having ever been in prison or in a psychiatric ward were predictive of seroconversion. HIV prevention efforts should address issues related to mental and social stability and serodiscordant relationships to reduce the risk of seroconversion.

As the HIV/AIDS pandemic enters its third decade, gay and bisexual men continue to be at increased risk of infection. In the early 1980s, the incidence of HIV was reported to be as high as 20% per year in this population [1]. Large-scale education and prevention campaigns led to a decline in risky behaviour and subsequently to declines in infections of HIV and other sexually transmitted diseases through the mid to late 1980s [1]. Although an initial risk reduction was achieved, data on sexual behaviour and HIV/sexually transmitted disease incidence suggest that this reduction has not been sustained [2,3]. Furthermore, reports from various cities across North America have reported an increase in the incidence of HIV among gay and bisexual men [4,5].

Numerous studies have examined risk factors associated with prevalent and incident HIV infections [3,6,7]. Among gay and bisexual men, unprotected receptive anal intercourse, the number of sexual partners, the use of cocaine, nitrite inhalants and the injection drugs have been shown to be independently associated with HIV seroconversion [8]. The current analysis was designed to identify sociocultural and transmission factors associated with seroconversion among young gay and bisexual men in Vancouver, a city with a recently documented increase in HIV incidence [4].

The Vanguard Project is an ongoing prospective cohort study initiated in 1995. The eligibility criteria and study methods have previously been described [7]. Men who tested HIV negative at the baseline visit were followed prospectively for HIV seroconversion. For 43 men who tested HIV positive at the baseline visit, the serological testing algorithm for recent HIV seroconversion was used to identify whether or not the individual had recently been infected with HIV

through previously described methods [9]. Nine individuals who were identified as having seroconverted within 170 days of their first HIV-positive test result were included as incident infections. Sociodemographic and behavioural data were obtained from the baseline questionnaire for these participants, as the baseline questionnaire was completed before the disclosure of their HIV test result.

HIV incidence was calculated as the number of new infections divided by the total person-time under observation from study inception to December 2001. Person-time was calculated as the interval between enrolment and the most recent follow-up visit for individuals who did not seroconvert. The median follow-up time was 35.9 months. For individuals who became HIV positive, person-time was calculated as the interval between enrolment and the date at which an HIV-positive test result was first detected. Ninety-five per cent confidence intervals (CI) for the incidence estimates were calculated on the basis of the Poisson distribution. Incidence rates of seroconversion by exposure category were calculated as the number of exposed men who seroconverted divided by the person-time attributed to the exposed category. Crude rates were calculated in the same manner for unexposed individuals. Predictors of seroconversion were determined using time-dependent Cox proportional hazards regression.

A total of 674 men were included in this analysis. The median age at baseline was 25 years (interquartile range 22–28 years) and 63 men (9.6%) were of Aboriginal heritage. A total of 612 men (91%) reported living in stable housing, 589 (88%) had at least a high-school education and 484 (72%) were employed at baseline.

Thirty-six individuals with incident HIV infection were identified over the study period; 27 of whom had tested HIV-negative at baseline and subsequently seroconverted and nine of whom were identified as incident HIV cases using the serological testing algorithm for recent HIV seroconversion. The incidence of HIV seroconversion in this cohort was found to be 1.9 per 100 person-years (pyr) (95% CI 1.3–2.5 per 100 pyr). In univariate analyses a comparison of sociodemographic variables revealed that men who had at least a high school education [risk ratio (RR) 0.2], lived in stable housing (RR 0.2) or were employed (RR 0.3) were less likely to seroconvert (Table 1). Conversely, Aboriginal men (RR 2.6), men who had ever been in a psychiatric ward (RR 6.8), a group home (RR 6.5) or in prison (RR 7.7) were at increased risk of seroconversion.

Men who reported involvement in the sex trade had a fivefold increase in the risk of becoming infected with HIV. Further sexual risk behaviours included unpro-

Table 1. HIV incidence according to reported sociodemographic and personal characteristics, sexual behaviour and substance use (n = 36).

	Yes rate ^a	No rate ^a	Hazard ratio (95% CI)
Ever in psychiatric ward	10.5	1.4	6.8 (3.1–14.9)
Ever in prison	10.4	1.2	7.7 (3.6–16.2)
Ever in group home	9.3	1.3	6.5 (3.1–13.7)
Aboriginal ethnicity	4.4	1.7	2.6 (1.1–6.0)
Income < Can\$10 000/year	2.5	1.4	1.6 (0.7–3.7)
Stable housing	1.5	9.5	0.2 (0.1–0.3)
High school education	1.3	6.7	0.2 (0.1–0.4)
Employed	1.1	5.6	0.3 (0.1–0.5)
Age (per year)			0.9 (0.8–1.0)
Receptive anal sex with HIV-positive partner	8.3	1.8	5.4 (1.6–17.7)
Involved in sex trade	7.0	1.4	5.0 (2.5–9.8)
Receptive anal sex with casual partner	7.0	1.2	5.1 (2.6–10.1)
Unprotected anal sex with HIV-positive partner	6.1	1.8	3.5 (1.2–9.9)
Insertive anal sex with casual partner	5.1	1.3	3.6 (1.9–7.1)
Receptive anal sex with regular partner	3.3	1.2	2.7 (1.4–5.4)
Insertive anal sex with regular partner	3.0	1.4	2.1 (1.1–4.2)
Non-consensual sex < 18 years of age	2.3	1.8	1.2 (0.6–2.4)
Number of regular partners (per partner)			1.02 (0.98–1.06)
Number of casual partners (per partner)			1.01 (1.00–1.01)
Injection drug use	9.2	1.5	6.8 (3.2–14.5)
Crack	8.4	1.4	6.1 (2.9–13.1)
Heroin	7.0	1.6	4.1 (1.7–10.2)
Cocaine	4.2	1.1	4.0 (2.0–7.9)
Crystal methamphetamines	4.1	1.4	3.1 (1.5–6.3)
Poppers	3.0	1.4	2.2 (1.1–4.3)
Marijuana	2.6	0.9	2.8 (1.2–6.4)
Ecstasy	2.1	1.7	1.3 (0.6–2.9)
At least 10 drinks/week	2.0	1.6	1.4 (0.6–3.34)

CI, Confidence interval.

^aPer 100 person-years.

tected insertive and receptive anal intercourse with both regular and casual partners. Men who engaged in unprotected insertive (RR 3.5) and receptive (RR 5.4) anal sex with a known HIV-positive partner were also at increased risk of seroconversion.

Injection drug use was associated with a sevenfold increase in the risk of HIV seroconversion. Furthermore, the use of marijuana (RR 2.8), crystal methamphetamine (RR 3.1), cocaine (RR 4.0), poppers (RR 2.2), crack (RR 6.1) and heroin (RR 4.1) were associated with an increased risk of seroconversion.

Multivariate Cox proportional hazards regression analysis was used to determine independent predictors of seroconversion. After adjustment for other variables significant in univariate analyses at $P \leq 0.05$, ever having been in prison was independently predictive of HIV seroconversion [adjusted risk ratio (ARR) 6.0; 95% CI 2.5–14.5]. Unprotected receptive anal sex with a known HIV-positive partner (ARR 6.5; 95% CI 2.1–19.9) or a casual partner regardless of serostatus (ARR 4.9; 95% CI 2.3–10.3) were independently associated with an increased risk of seroconversion. A history of having been in a psychiatric ward was also independently predictive of HIV seroconversion (ARR 3.8; 95% CI 1.5–9.9). In a sub-analysis excluding known sexual and injection-related transmission variables, having ever been in prison (ARR 5.1; 95% CI 2.2–12.3) and having ever been in a psychiatric ward (ARR 3.7; 95% CI 1.5–9.2) were independent predictors of seroconversion.

Incarceration, in both prison and in a psychiatric ward were found to be independently associated with HIV seroconversion. A high prevalence of HIV has been reported among individuals entering prison [10], and prisoners have been reported to engage in high-risk sexual or drug use behaviours when incarcerated [11]. Among men in this study who had ever been in prison, 53% had recently injected drugs. Unfortunately, it is not possible to determine what, if any, risk behaviours individuals who had been in prison may have engaged in when incarcerated. However, the relationship between imprisonment and HIV seroconversion among young gay and bisexual men warrants further investigation.

Individuals with chronic mental illness have been shown to have a high prevalence of HIV [12]. This increased prevalence is related to an increased vulnerability to HIV infection because of their young age, multiple sex partners, use of injection drugs, and transient sexual relationships [13]. The geographical concentration in inner city neighbourhoods may also increase the prevalence of HIV risk behaviours [14] or exposure to HIV as a result of increased prevalence.

Risky sexual behaviours were shown to be characteristics of men who seroconverted in this study. Sexual risk behaviour, particularly unprotected receptive anal intercourse, has been shown to be associated with HIV seroconversion [7,15]. The results of this study support these findings by showing that men who engaged in unprotected receptive anal intercourse with casual partners or known HIV-positive partners were significantly more likely to become infected with HIV.

This study provides a risk profile of young gay and bisexual men who have recently become infected with HIV. The results presented here are supportive of previous work in this area, in addition to highlighting the risks associated with being institutionalized, as evidenced by the significance of incarceration and hospitalization in multivariate modelling when known transmission variables were excluded. Personalized prevention messages designed for young gay and bisexual men, particularly those in vulnerable socioeconomic situations, must be designed in order to prevent a further increase in HIV infections.

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