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Homelessness and Unstable Housing Associated with an Increased Risk of HIV and STI Transmission among Street-Involved Youth

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Abstract

The role that environmental factors play in driving HIV and STI transmission risk among street-involved youth has not been well examined. We examined factors associated with number of sex partners using quasi-Poisson regression and consistent condom use using logistic regression among participants enrolled in the At Risk Youth Study. Among 529 participants, 253 (47.8%) reported multiple partners while only 127 (24.0%) reported consistent condom use in the past six months. Homelessness was inversely associated with consistent condom use (adjusted odds ratio [aOR]=0.47, $p=0.008$), while unstable housing was positively associated with greater numbers of sex partners (adjusted incidence rate ratio [aIRR]=1.44, $p=0.010$). These findings indicate the need for interventions which modify environmental factors that drive risk among young street-involved populations.

Keywords

Adolescent; Homeless Youth; Sexual Behavior; Substance Use; HIV

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INTRODUCTION

Populations of homeless and street-involved youth are increasing in many North American settings (Public Health Agency of Canada, 2006b). In Canada, it has been estimated that there are upwards of 150,000 street-involved youth (DeMatteo et al., 1999). Although street youth are known to be at increased risk for a host of negative health outcomes, some of the most commonly reported concerns among this population are sexual and reproductive health issues (Frankish et al., 2005; Feldmann and Middleman, 2003). Many studies of street-involved youth have documented drastically elevated rates of HIV, sexually transmitted infections (STIs), and other blood borne diseases, including hepatitis B (HBV) and hepatitis C (HCV) (Roy et al., 2001; Roy et al., 1999; Roy et al., 2003b; Pfeifer and Oliver, 1997; Allen et al., 1994; Noell et al., 2001a). The prevalence of HIV among street-involved youth in Montreal (Roy et al., 2000) and Toronto (DeMatteo et al., 1999) has been estimated to be approximately 2%, while some studies in the United States have documented rates over 8% (Shalwitz et al., 1990; Rew et al., 2002; Pfeifer and Oliver, 1997). A recent report by the Public Health Agency of Canada indicated that the prevalence of *Chlamydia trachomatis* (CT) among Canadian street youth is at least ten times that of the general adolescent populations (Public Health Agency of Canada, 2006a), while cross-sectional studies have documented CT rates between 6.6% and 8.6% (Haley et al., 2002; Shields et al., 2004).

To explain the elevated rates of HIV and STIs among this population, epidemiological studies have described a range of sexual risk behaviours. The vast majority of street-involved youth are sexually active, among whom inconsistent condom use (i.e., not always using condoms with all sexual partners) is reported by 50% to 80% (Halcon and Lifson, 2004; Moon et al., 2001; de Carvalho et al., 2006; Milburn et al., 2006; Kissin et al., 2007). Street-involved youth are also likely to report multiple recent sexual partnerships. For example, the median number of sex partners in the past six months has been found to vary between 1 and 6 (Moon et al., 2000; Zimet et al., 1995; Montgomery et al., 2002; Zanetta et al., 1999). Furthermore, studies in Canada and the US suggest that approximately one quarter of street-involved youth have ever exchanged sex for money, drugs, shelter, or gifts (Kipke et al., 1995; Greene et al., 1999; Weber et al., 2002).

Along with sociodemographic factors such as age, gender, and ethnicity, commonly reported correlates of sexual risk behaviour among street-involved youth include: childhood sexual abuse (Stoltz et al., 2007; Noell et al., 2001b); depression (Rohde et al., 2001); relationship status (Evans et al., 2003; Coady et al., 2007); sexual decision making (Harvey et al., 2003); and a range of drug-related factors, including injection drug use (Haley et al., 2004; Gleghorn et al., 1998; Solorio et al., 2008). While the majority of studies have focused primarily on the individual, social and drug-related factors that predict engagement in sexual risk behaviour, less is known about the environmental influences that may impact the risk factors for HIV and STI transmission among youth. However, a growing body of literature has documented the association between homelessness and HIV transmission among adults and the link between housing status and health outcomes of people living with HIV (Wolitski et al., 2007). For example, unstable housing has been associated with elevated HIV incidence among injection drug users (Corneil et al., 2006), while a dose-response relationship between number of residences lived in and the likelihood of unprotected intercourse has been observed among incarcerated women at high risk for HIV (Weir et al., 2007). Furthermore, female drug users who remain in unstable housing environments are less likely to reduce HIV-related risk behaviours as compared to individuals who become stably housed (Elifson et al., 2007). Homelessness and residential instability have also been associated with exposure to sexual and drug-related HIV risk among young men who have sex with men (MSM) (Kipke et al., 2007; Clatts et al., 2005).

To date, research examining the impact of homelessness on HIV risk behaviour among street-involved youth is equivocal. In a multi-site study of high risk adolescents conducted in the US, homelessness was found to be associated with HIV positivity, but only among males (Huba et al., 2000). A prospective study of newly homeless youth observed no significant association between future housing stability and sexual risk behaviour (Rosenthal et al., 2007); however, several studies have found that duration of homelessness is a predictor of behavioral outcomes associated with sexual health (Ennett et al., 1999; Rew et al., 2008; Milburn et al., 2006). There exists a lack of knowledge regarding how specific physical conditions associated with these periods of homelessness may influence sexual risk behaviour. Given that street-involved youth reside in a wide variety of settings (e.g., shelters, hostels, vehicles, parks, and other public spaces) (Greenblatt and Robertson, 1993; Daly, 1996), elucidating how specific environments may promote behaviours which drive the transmission of HIV and STIs is important to furthering our understanding of the multi-level factors that determine population level disease burden. Therefore, we conducted this study to determine if environmental factors, independent of individual level characteristics, predict engagement in sexual risk behaviour among a sample of street-involved youth.

METHODS

The At Risk Youth Study (ARYS) is an ongoing prospective cohort of homeless and street-involved youth in Vancouver, Canada. The study has been described in detail previously (Wood et al., 2006). Briefly, the study consists of a convenience sample recruited through extensive street-based outreach and snowball sampling in which street youth were encouraged to recruit their peers. Outreach teams consisting of street nurses and study staff worked in close collaboration with local youth service organizations and agencies to refine the recruitment process and to ensure that specific hidden subpopulations (e.g., street youth who identify as lesbian, gay, bisexual, transsexual, or transgendered [LGBTT]) were represented. Furthermore, these organizations were encouraged to refer eligible youth to the study. Although these recruitment techniques are inferior to a random probability-based sampling, extensive efforts were taken to maximize the representativeness of the sample. For example, outreach was systematically conducted in a range of city neighbourhoods in areas where street youth are known to congregate, including shelters, youth services, and on the street. Outreach was also conducted at different times during the day and at night.

The term “street-involved youth” has been defined as an adolescent who spends a substantial amount of time on the street or is heavily engaged in the street economy (Marlatt, 2002), and may include youth who are absolutely, periodically, or at imminent risk of being homeless (Daly, 1996). As in previous studies of street-involved youth (Roy et al., 2003a; DeMatteo et al., 1999), housing status was not included as an eligibility criterion in order to capture as much as possible the diverse spectrum of street youth. Specific eligibility criteria included being between the age of 14 and 26 years of age at baseline, illicit drug use other than or in addition to marijuana in the past 30 days, and the provision of informed consent. At baseline and semi-annually, participants complete an interviewer-administered questionnaire and provide blood samples for HIV and hepatitis C (HCV) serology. All participants receive a monetary stipend of \$20 CDN after each visit. The study has been approved by the University of British Columbia/Providence Health Care Research Ethics Board.

All participants who were recruited and completed a baseline survey between September 1, 2005 and October 31, 2006 were included in this cross-sectional analysis. The primary outcomes of interest in this study were number of sexual partners in the past 6 months and condom use during vaginal and anal intercourse during the past 6 months. Participants were asked to report how many male and female partners they had engaged in sexual activities with, excluding those with whom they had engaged in sex for money, drugs, shelter, or gifts. Since

sex work is known to be associated with a profile of sexual risk behaviour distinct from that in the context of voluntary sex among both male and female street youth (Haley et al., 2004; Weber et al., 2004), we chose to omit this activity from our analyses. For both same and opposite sex partnerships, participants were also asked to report how often a condom was used during vaginal and anal intercourse. Possible responses included: always, regularly, occasionally, and never. To be consistent with previous studies of condom use among street-involved youth (de Carvalho et al., 2006; Moon et al., 2001), this variable was dichotomized into “consistent” (i.e., always) and “inconsistent” (i.e., regularly, occasionally, or never) condom use. Participants who reported more than one type of sexual activity in the past six months and who reported discordant condom use patterns were coded as inconsistent condom users.

The primary explanatory variable of interest in this study was current place of residence. For analytical purposes, we created a categorical variable with the following three levels: 1) stably housed – living in an apartment, house or single room occupancy hotel (SRO); 2) unstably housed – living in a shelter or hostel; and 3) homeless – living on the street or having no fixed address (NFA). Other independent variables included a range of sociodemographic, individual level, drug-related, and social factors, and were chosen based on their known or *a priori* hypothesized relationship with both housing status and one or both of the sexual risk behaviours listed above. Sociodemographic variables that were examined included: age (per year older), sex (female vs. male), Aboriginal ethnicity (yes vs. no) and sexual orientation (LGBT vs. heterosexual). Other individual level factors that were examined included engaging in anal intercourse in the past six months (yes vs. no), sexual abuse (yes vs. no), depression, and self-efficacy for limiting HIV risk behaviours (LHRB). Sexual abuse was defined as answering “yes” to the question, “Have you ever been sexually abused?”, while the latter two variables were defined using validated, published scales. The Center for Epidemiologic Studies Depression Scale (CES-D) is designed to measure current levels of depressive symptoms and has been shown to have high levels of internal consistency and reliability among groups of adolescents (Radloff, 1977; Rushton et al., 2002). The presence of depressive symptoms was evaluated using a well-defined cut-off (CES-D ≥ 16 [yes] versus CES-D < 16 [no]). The self-efficacy for LHRB Scale is a validated instrument found to have high levels of consistency among at-risk youth (Smith et al., 1996; Kang et al., 2004). Self-efficacy refers to the belief in one’s capability of performing actions to attain certain goals (Bandura, 1986); therefore, the LHRB Scale consists of questions that require a respondent to record how sure they are that they could perform sexual and injection-related risk reduction behaviours, such as talking about safe sex with a partner, using a condom correctly during sex, and refusing to share needles with friends. Responses were dichotomized into “high” versus “low” self-efficacy for LHRB based on their value with respect to the sample median. Social and drug-related factors that were examined included: relationship status (single or casually dating vs. regular partner or married), drug dealing (yes vs. no), alcohol dependence (yes vs. no), crack use (yes vs. no), cocaine use (yes vs. no), heroin use (yes vs. no), crystal methamphetamine use (yes vs. no), injection drug use (yes vs. no), and sharing syringes (yes vs. no). Alcohol dependence was measured using the Perceived-Benefit-of-Drinking Scale (PBDS), a 5-item true/false validated instrument that is used to assess drinking behaviours among adolescents (Petchers and Singer, 1987; Petchers et al., 1988). A standard *a priori* defined cut-off of three or higher was used to define alcohol dependence. All other drug-use variables refer to behaviours occurring in the past six months: cocaine, heroin, and crystal methamphetamine use refer to both injection and inhalation routes of consumption. To be consistent with our previous work, syringe sharing was defined as lending or borrowing a used syringe in the past six months (Kerr et al., 2005). Since sexual risk behaviours are known to be interdependent (Aral, 2004), each dependent variable was included as a potential explanatory variable when not used as the primary dependent variable of interest.

Initially, we examined bivariate associations between the individual level, social, drug-related and environmental variables and each sexual risk behaviour outcome. To analyse the sexual partnership data, a Poisson-type regression was used to estimate the unadjusted incidence rate ratio (IRR) and 95% confidence intervals (95% CI) associated with each independent variable. The distribution of recent sex partners was highly skewed; therefore, in order to account for overdispersion, we used a log-linear quasi-Poisson regression. This approach relaxes the assumption that the variance of the underlying distribution is equal to the mean by allowing the variance to be modeled as a linear function of the mean (McCullagh and Nelder, 1999; Ver Hoef and Boveng, 2007). To analyse the bivariate associations with consistent condom use, dichotomous and categorical variables were examined using the Pearson χ^2 test.

Since the objective of this study was to determine whether environmental conditions, independent of established sociodemographic and individual level factors, are associated with sexual risk behaviour, we fit a series of confounding models based on an approach described by Rothman and Greenland (Rothman and Greenland, 1998; Maldonado and Greenland, 1993). For a variable to be considered a confounder in the relationship between place of residence and sexual risk behaviour, it must be associated with both the behaviour and with housing status. Therefore, we conducted initial bivariate screenings based on a conservative p -value of 0.20 to determine which explanatory variables were associated with the outcome and thus may be potential confounders. We then used these variables to create two multivariate “full” models. These models were then subjected to a manual stepwise approach to select significant confounders. Starting with the “full” models, variables that did not alter the relative change in the coefficient of the primary variable of interest by more than 10% were removed in a sequential fashion. Since the primary variable of interest was categorical with two levels, variables were considered significant confounders if their removal altered one or both of the coefficients by more than 10%. This technique has been described and used successfully by several authors (Lima et al., 2007; Lima and Kopec, 2005; Maldonado and Greenland, 1993). To account for the well-established confounding effects of age, sex, ethnicity, and sexual orientation, these variables were forced into the “full” models and were not subjected to the stepwise procedure. All statistical modelling was conducted using S-PLUS software version 8.0. All reported p -values are two-sided.

RESULTS

A total of 529 participants completed a baseline interview between September 2005 and October 2006. As shown in Table 1, the mean age was 21.9 (standard deviation [SD] = 2.8), 159 (30.1%) were female, 127 (24.0%) were of Aboriginal ethnicity, and 69 (13.0%) self-identified as non-heterosexual. The sociodemographic characteristics of this sample are similar to a Vancouver street youth study conducted in 2003 in which the mean age was 22.2 (SD = 3.1), 28.2% of participants were female, and 24.0% self-identified as Aboriginal (Martin et al., 2006). A national survey of urban street youth conducted in 2003 observed a mean age of 19.7 with a similar proportion of females (37.1%) but a higher proportion of Aboriginals (36.3%) (Public Health Agency of Canada, 2006b). Sexual activity in the past six months was reported by 415 (78.4%), of whom 253 (61.0%) reported multiple sex partners and 127 (30.6%) reported consistent condom use. The median number of sex partners in the past six months was 1 (interquartile range: 1 – 3; range: 0 – 55).

The results of the bivariate quasi-Poisson analyses are shown in Table 2. As a group, housing status was statistically significant (type 3 p -value < 0.001, 2 df). Additional pairwise comparisons revealed that living in a shelter or hostel (incidence rate ratio [IRR] = 1.65, 95% confidence interval [95% CI]: 1.12 – 2.43) was positively associated with greater numbers of sex partners, and living NFA or on the street was marginally significant (IRR = 1.40, 95% CI: 0.98 – 2.01). Other variables that were positively associated with greater numbers of sex

partner included: LGBTT orientation (IRR = 1.90, 95% CI: 1.37 – 2.63); being single or casually dating (IRR = 1.79, 95% CI: 1.19 – 2.69); low self-efficacy for LHRB (IRR = 1.55, 95% CI: 1.14 – 2.13); sometimes/occasionally using condoms (IRR = 1.52, 95% CI: 1.10 – 2.10); anal intercourse (IRR = 2.52, 95% CI: 1.83 – 3.48); sexual abuse (IRR = 1.67, 95% CI: 1.25 – 2.24); crack use (IRR = 1.45, 95% CI: 1.07 – 1.98); and cocaine use (IRR = 1.62, 95% CI: 1.20 – 2.19). Never using condoms (IRR = 0.56, 95% CI: 0.35 – 0.90) was inversely associated with number of sex partners. In a multivariate confounding model (see Table 2), housing status remained statistically significant (type 3 p -value < 0.001, df = 2), and additional pairwise comparisons revealed that living in a shelter or hostel was independently associated with greater numbers of sex partners (adjusted incidence rate ratio [aIRR] = 1.44, 95% CI: 1.09 – 1.90). Other factors that remained significant in the final model included: female gender (aIRR = 0.65, 95% CI: 0.49 – 0.87); Aboriginal ethnicity (aIRR = 0.75, 95% CI: 0.56 – 0.99); LGBTT orientation (aIRR = 1.75, 95% CI: 1.29 – 2.36); never using condoms (aIRR = 0.46, 95% CI: 0.31 – 0.68); anal intercourse (aIRR = 1.47, 95% CI: 1.13 – 1.91); sexual abuse (aIRR = 1.40, 95% CI: 1.09 – 1.79); crack use (aIRR = 1.46, 95% CI: 1.14 – 1.87); and cocaine use (aIRR = 1.39, 95% CI: 1.10 – 1.74).

The factors associated with consistent condom use in bivariate analyses are shown in Table 3. Overall, housing status was marginally significant (type 3 p -value = 0.077, 2 df). Additional pairwise comparisons revealed that living NFA or on the street (odds ratio [OR] = 0.56, 95% CI: 0.35 – 0.92) was significantly and inversely associated with consistent condom use. Other variables that were significantly (p < 0.05) associated with consistent condom use included: being single or casually dating ([OR] = 2.50, 95% CI: 1.46 – 4.30); LGBTT orientation (OR = 0.42, 95% CI: 0.20 – 0.90); and engaging in anal intercourse (OR = 0.41, 95% CI: 0.21 – 0.79). The results of the multivariate analysis are shown in Table 4. Housing status was independently associated with consistent condom use (type 3 p -value < 0.001, df = 2), and additional pairwise comparisons revealed that youth living NFA or on the street were significantly less likely to report consistent condom use (adjusted odds ratio [aOR] = 0.47, 95% CI: 0.27 – 0.82). In addition to housing status, being single or casually dating (aOR = 3.50, 95% CI: 1.89 – 6.50) and LGBTT orientation (aOR = 0.43, 95% CI: 0.19 – 0.98) were significantly associated with consistent condom use in the final confounding model.

We also conducted a sensitivity analysis to determine if our model selection procedure significantly impacted the observed associations between housing status and sexual risk behaviours. Implementing an alternate model selection protocol whereby all variables significant in bivariate analyses (p < 0.10) were included did not significantly alter our results (data not shown). We also sought to examine whether the observed associations between LGBTT orientation and sexual risk behaviours were confounded by sex. An analysis of variance (ANOVA) revealed no significant difference between non-heterosexual men and non-heterosexual women with respect to the mean number of recent sexual partners (p = 0.068), while Fisher's exact test revealed no significant difference in consistent condom use by sex when the sample was restricted to LGBTT participants (p = 0.720).

DISCUSSION

In the present study, we observed a high prevalence of multiple sexual partnerships and inconsistent condom use among a community-recruited cohort of street-involved adolescents. In multivariate analyses, we observed that housing status was a strong and independent correlate of both greater numbers of sex partners and inconsistent condom use, even after adjustment for sociodemographic, drug-related, and other individual level confounders. In particular, living in a shelter or hostel was positively associated with an elevated number of recent sex partners, while living NFA or on the street was inversely associated with consistent condom use. Since both the transmissibility of infection (determined in part by condom use)

and the rate of sex partner change are key parameters that determine population-level HIV and STI incidence (Vickerman and Watts, 2003; May and Anderson, 1987), these findings indicate that precarious housing environments may act synergistically to increase sexual HIV and STI transmission among young street-involved populations.

We observed that specific housing and shelter environments appear to have distinct yet important impacts on sexual risk behaviours, independent of measured sociodemographic and individual level factors. Our finding that shelter and hostel-style housing conditions were correlated with an increased number of sexual partnerships is consistent with studies of other marginalized youth populations, including young MSM (Kipke et al., 2007), young IDU (Coady et al., 2007), and HIV positive adolescents (Eastwood and Birnbaum, 2007). Our findings suggest that conditions associated with the unique environment of shelter and hostel-based residences may play an important role in influencing behaviours that drive HIV and STI transmission, irrespective of individual level determinants such as depression, childhood trauma, and self-efficacy. For example, shelters and hostels in which a high turnover of clients is common may facilitate elevated rates of partner change among residents, particularly if cramped conditions necessitate the sharing of beds or sleeping quarters. Such environments may also facilitate discordant sexual mixing patterns that promote the transmission of HIV and other STIs (Aral et al., 2007); for example, young or recently homeless adolescents may be more likely to come in to contact with older, higher HIV/STI prevalence populations within shelter or hostel-based environments. Given that numerous epidemiological studies have shown how discordant mixing patterns can fuel the spread of HIV and STIs, particularly among low prevalence populations (Aral, 2002; Aral et al., 1999; Lee et al., 2003), future research should be conducted to examine more carefully the social-sexual networks of sheltered and unstably housed youth.

We also observed that over two thirds of sexually active youth reported inconsistent condom use with their recent sex partners, a prevalence similar to that observed in other North American and international settings (Kral et al., 1997; Solorio et al., 2006; de Carvalho et al., 2006; Kissin et al., 2007). Furthermore, those who were currently living NFA or on the street were twice as likely to report inconsistent condom use with their recent sexual partner(s). This effect remained significant even after accounting for potentially confounding factors such as relationship status, drug and injection-related risk behaviours, and a range of sociodemographic characteristics. Therefore, it is plausible that exposure to street environments, in particular living in deprived street-based conditions, may impact condom use patterns. While less is known regarding the influence of public and street-based environments on condom use, there exists an extensive literature describing how micro- and macro-environmental factors impact injection-related risk behaviour (Kerr et al., 2007). For example, public injection in which rushed, unsanitary injections are common has been linked to an array of HIV and health-related harms (Rhodes et al., 2006; Small et al., 2007; Clatts et al., 2001). Analogously, studies of MSM who have sex in public environments have observed low rates of condom use, which may be due to rushed encounters stemming from the fear of being harassed by police and homophobic individuals or groups (Somlai et al., 2001; French et al., 2000). Although youth who report living NFA or on the street likely have sex in a number of public, semi-public, and private environments, these results indicate that similar environmental mechanisms may play a role in structuring the context in which sexual risk behaviour and HIV/STI transmission among street-involved youth occurs.

Our results have a number of important implications for policy makers, health care workers, and youth organizations seeking to implement policies, laws, and programs that aim to reduce HIV and STI transmission among young street-involved populations. While historically youth sexual health interventions have privileged individual level determinism as the primary mechanism for enacting behaviour change, such programs often fail to result in sustained,

population level health outcomes (Shoveller et al., 2006; Aral, 2002). Furthermore, it has been argued that such programs are unable to account for the social, environmental, and structural context in which HIV and STI risk produced (Rhodes et al., 2005; Frye et al., 2006; Shoveller et al., 2006; Kerrigan et al., 2006). Our results support these arguments and provide quantitative evidence that sexual risk behaviour is associated with and possibly perpetuated by environmental factors, including housing conditions. As such, we recommend that future policies and programs implement structural-environmental interventions within preexisting health-based infrastructures. Multiple studies, including several intervention trials, have demonstrated that rent subsidy programs are highly effective at reducing the risk of future homelessness and mitigating HIV risk behaviour among persons living with HIV and AIDS (Dasinger and Speigman, 2007; Scott et al., 2007; Aidala et al., 2005; Elifson et al., 2007) and among low-income families (Shinn et al., 1998). Similar programs are likely to be equally effective for marginalized and at-risk youth. Given that rental prices in our setting for low-income and SRO housing increased by almost 8% from 2005 to 2007 (City of Vancouver, 2007), policies and structural-environmental interventions that prioritize the provision of safe and stable housing for homeless and street-involved youth are urgently required in our setting.

The present study has several limitations that should be noted. Although extensive snowball and outreach-based sampling methods were conducted in an attempt to derive a representative sample of street-involved youth, we are unable to generalize our results to the entire street youth population in Vancouver. With respect to this concern, it is noteworthy that the demographic profile of our sample is very similar to other studies of street-involved adolescents that have been conducted in our setting previously (Ochnio et al., 2001; Martin et al., 2006). However, it is important to note that particularly hard to reach subpopulations of street youth such as those under the age of 14 remain underrepresented in our and in other studies. Secondly, self-reported sexual behaviours are known to be highly susceptible to reporting and recall bias. Since the accuracy of such reports increases with shorter recall periods (Fenton et al., 2001), we attempted to maximize the accuracy of the data by restricting our analysis to recent (past six month) behaviours and outcomes. Thirdly, our analyses were restricted to sexual activity that did not occur in the context of sex in exchange for money, drugs, gifts, or shelter. Future research should be conducted to examine the specific environmental factors associated with sexual risk behaviour and HIV/STI transmission among young street-involved sex workers in Vancouver. Lastly, the data is cross-sectional, and therefore the relationships between explanatory variables and sexual risk behaviour outcomes do not imply causality. In particular, causal inferences with respect to housing conditions and street youth sexual behaviour must be tempered by the fact that only current place of residence was assessed and individuals may have lived in multiple locations over the six month period of interest. Future studies should examine longitudinally whether the frequency at which street-involved youth change housing conditions impacts the likelihood of engagement in sexual risk behaviours.

In summary, the results of our study suggest that housing status may influence sexual risk behaviour and therefore may play an important role in driving HIV and STI transmission among street-involved youth. Along with LGBTT orientation, housing status was independently associated with both greater numbers of sex partners and inconsistent condom use. These results support the adoption and evaluation of structural-environmental frameworks that explicitly include environmental determinants of HIV and STI transmission, and suggest that policies, law, and programs be restructured to prioritize housing conditions and other environmental factors as primary prevention strategies. Our results add to a growing literature that indicates HIV and STI prevention efforts must target the environmental-structural contexts in which disease is transmitted and risk is produced.

References

- Aidala A, Cross JE, Stall R, Harre D, Sumartojo E. Housing status and HIV risk behaviors: Implications for prevention and policy. *AIDS and Behavior* 2005;9(3):251–265. [PubMed: 16088369]
- Allen DM, Lehman JS, Green TA, Lindegren ML, Onorato IM, Forrester W. HIV infection among homeless adults and runaway youth, United States, 1989–1992. *AIDS* 1994;8(11):1593–1598. [PubMed: 7848596]
- Aral SO. Determinants of STD epidemics: Implications for phase appropriate intervention strategies. *Sexually Transmitted Infections* 2002;78(Suppl 1):i3–i13. [PubMed: 12083444]
- Aral SO. Sexual risk behaviour and infection: Epidemiological considerations. *Sexually Transmitted Infections* 2004;80(Suppl 2):ii8–ii12. [PubMed: 15572645]
- Aral SO, Hughes JP, Stoner B, Whittington W, Handsfield HH, Anderson RM, Holmes KK. Sexual mixing patterns in the spread of gonococcal and chlamydial infections. *American Journal of Public Health* 1999;89(6):825–833. [PubMed: 10358670]
- Aral SO, Lipshutz J, Blanchard J. Drivers of STD/HIV epidemiology and the timing and targets of STD/HIV prevention. *Sexually Transmitted Infections* 2007;83(Suppl 1):i1–i4. [PubMed: 17664361]
- Bandura, A. Social foundations of thought and action: A social cognitive theory. Prentice Hall; Englewood Cliff, NJ: 1986.
- City of Vancouver. Survey of Low-Income Housing in the Downtown Core. 2007. Viewed February 27, 2008, <<http://vancouver.ca/commsvcs/housing/pdf/2007SRAsurvey.pdf>>
- Clatts MC, Goldsamt L, Yi H, Gwadz MV. Homelessness and drug abuse among young men who have sex with men in New York city: A preliminary epidemiological trajectory. *Journal of Adolescence* 2005;28(2):201–214. [PubMed: 15878043]
- Clatts MC, Welle DL, Goldsamt LA. Reconceptualizing the interaction of drug and sexual risk among MSM speed users: Notes toward an ethnoepidemiology. *AIDS and Behavior* 2001;5(2):115–130.
- Coady MH, Latka MH, Thiede H, Golub ET, Ouellet L, Hudson SM, Kapadia F, Garfein RS. Housing status and associated differences in HIV risk behaviors among young injection drug users (IDUs). *AIDS and Behavior* 2007;11(6):854–863. [PubMed: 17551825]
- Cornell TA, Kuyper LM, Shoveller J, Hogg RS, Li K, Spittal PM, Schechter MT, Wood E. Unstable housing, associated risk behaviour, and increased risk for HIV infection among injection drug users. *Health & Place* 2006;12(1):79–85. [PubMed: 16243682]
- Daly, GP. Homeless: Policies, Strategies, and Lives on the Street. Routledge; London: 1996.
- Dasinger LK, Speiglmann R. Homelessness prevention: The effect of a shallow rent subsidy program on housing outcomes among people with HIV or AIDS. *AIDS and Behavior* 2007;11(Suppl 2):S128–S139.
- de Carvalho FT, Neiva-Silva L, Ramos MC, Evans J, Koller SH, Piccinini CA, Page-Shafer K. Sexual and drug use risk behaviors among children and youth in street circumstances in Porto Alegre, Brazil. *AIDS and Behavior* 2006;10(Suppl 1):S57–S66. [PubMed: 16845605]
- DeMatteo D, Major C, Block B, Coates R, Fearon M, Goldberg E, King SM, Millson M, O'Shaughnessy M, Read SE. Toronto street youth and HIV/AIDS: Prevalence, demographics, and risks. *Journal of Adolescent Health* 1999;25(5):358–366. [PubMed: 10551667]
- Eastwood EA, Birnbaum JM. Physical and sexual abuse and unstable housing among adolescents with HIV. *AIDS and Behavior* 2007;11(Suppl 2):S116–S127.
- Elifson KW, Sterk CE, Theall KP. Safe living: The impact of unstable housing conditions on HIV risk reduction among female drug users. *AIDS and Behavior* 2007;11(Suppl 2):S45–S55.
- Ennett ST, Federman EB, Bailey SL, Ringwalt CL, Hubbard ML. HIV-risk behaviors associated with homelessness characteristics in youth. *Journal of Adolescent Health* 1999;25(5):344–353. [PubMed: 10551665]
- Evans JL, Hahn JA, Page-Shafer K, Lum PJ, Stein ES, Davidson PJ, Moss AR. Gender differences in sexual and injection risk behavior among active young injection drug users in San Francisco (the UFO Study). *Journal of Urban Health* 2003;80(1):137–146. [PubMed: 12612103]
- Feldmann J, Middleman AB. Homeless adolescents: Common clinical concerns. *Seminars in Pediatric Infectious Diseases* 2003;14(1):6–11. [PubMed: 12748916]

- Fenton KA, Johnson AM, McManus S, Erens B. Measuring sexual behaviour: Methodological challenges in survey research. *Sexually Transmitted Infections* 2001;77(2):84–92. [PubMed: 11287683]
- Frankish CJ, Hwang SW, Quantz D. Homelessness and health in Canada: Research lessons and priorities. *Canadian Journal of Public Health* 2005;96(Suppl 2):S23–S29.
- French R, Power R, Mitchell S. An evaluation of peer-led STD/HIV prevention work in a public sex environment. *AIDS Care* 2000;12(2):225–234. [PubMed: 10827864]
- Frye V, Latka MH, Koblin B, Halkitis PN, Putnam S, Galea S, Vlahov D. The urban environment and sexual risk behavior among men who have sex with men. *Journal of Urban Health* 2006;83(2):308–324. [PubMed: 16736379]
- Gleghorn AA, Marx R, Vittinghoff E, Katz MH. Association between drug use patterns and HIV risks among homeless, runaway, and street youth in northern California. *Drug and Alcohol Dependence* 1998;51(3):219–227. [PubMed: 9787995]
- Greenblatt M, Robertson MJ. Life-styles, adaptive strategies, and sexual behaviors of homeless adolescents. *Hospital and Community Psychiatry* 1993;44(12):1177–1180. [PubMed: 8132191]
- Greene JM, Ennett ST, Ringwalt CL. Prevalence and correlates of survival sex among runaway and homeless youth. *American Journal of Public Health* 1999;89(9):1406–1409. [PubMed: 10474560]
- Halcon LL, Lifson AR. Prevalence and predictors of sexual risks among homeless youth. *Journal of Youth and Adolescence* 2004;33(1):71–80.
- Haley N, Roy E, Leclerc P, Boudreau JF, Boivin JF. HIV risk profile of male street youth involved in survival sex. *Sexually Transmitted Infections* 2004;80(6):526–530. [PubMed: 15572629]
- Haley N, Roy E, Leclerc P, Lambert G, Boivin JF, Cedras L, Vincelette J. Risk behaviours and prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae genital infections among Montreal street youth. *International Journal of STD & AIDS* 2002;13(4):238–245. [PubMed: 11886608]
- Harvey SM, Bird ST, De Rosa CJ, Montgomery SB, Rohrbach LA. Sexual decision making and safer sex behavior among young female injection drug users and female partners of IDUs. *Journal of Sex Research* 2003;40(1):50–60. [PubMed: 12806531]
- Huba GJ, Melchior LA, Panter AT, Trevithick L, Woods ER, Wright E, Feudo R, Tierney S, Schneir A, Tenner A, Remafedi G, Greenberg B, Sturdevant M, Goodman E, Hodgins A, Wallace M, Brady RE, Singer B. Risk factors and characteristics of youth living with, or at high risk for, HIV. *AIDS Education and Prevention* 2000;12(6):557–575. [PubMed: 11220507]
- Kang SY, Deren S, Andia J, Colon HM, Robles R. Effects of changes in perceived self-efficacy on HIV risk behaviors over time. *Addictive Behaviors* 2004;29(3):567–574. [PubMed: 15050674]
- Kerr T, Kimber J, Rhodes T. Drug use settings: An emerging focus for research and intervention. *International Journal of Drug Policy* 2007;18(1):1–4. [PubMed: 17689337]
- Kerr T, Tyndall M, Li K, Montaner J, Wood E. Safer injection facility use and syringe sharing in injection drug users. *Lancet* 2005;366(9482):316–318. [PubMed: 16039335]
- Kerrigan D, Moreno L, Rosario S, Gomez B, Jerez H, Barrington C, Weiss E, Sweat M. Environmental-structural interventions to reduce HIV/STI risk among female sex workers in the Dominican Republic. *American Journal of Public Health* 2006;96(1):120–125. [PubMed: 16317215]
- Kipke MD, O'Connor S, Palmer R, MacKenzie RG. Street youth in Los Angeles. Profile of a group at high risk for human immunodeficiency virus infection. *Archives of Pediatrics & Adolescent Medicine* 1995;149(5):513–519. [PubMed: 7735403]
- Kipke MD, Weiss G, Wong CF. Residential status as a risk factor for drug use and HIV risk among young men who have sex with men. *AIDS and Behavior* 2007;11(Suppl 2):S56–S69.
- Kissin, DM.; Zapata, L.; Yorick, R.; Vinogradova, EN.; Volkova, GV.; Cherkassova, E.; Lynch, A.; Leigh, J.; Jamieson, DJ.; Marchbanks, PA.; Hillis, S. HIV seroprevalence in street youth. Vol. 21. St. Petersburg, Russia: AIDS; 2007. p. 2333-2340.
- Kral AH, Molnar BE, Booth RE, Watters JK. Prevalence of sexual risk behaviour and substance use among runaway and homeless adolescents in San Francisco, Denver and New York City. *International Journal of STD & AIDS* 1997;8(2):109–117. [PubMed: 9061410]
- Lee JK, Jennings JM, Ellen JM. Discordant sexual partnering: A study of high-risk adolescents in San Francisco. *Sexually Transmitted Diseases* 2003;30(3):234–240. [PubMed: 12616143]

- Lima VD, Geller J, Bangsberg DR, Patterson TL, Daniel M, Kerr T, Montaner JS, Hogg RS. The effect of adherence on the association between depressive symptoms and mortality among HIV-infected individuals first initiating HAART. *AIDS* 2007;21(9):1175–1183. [PubMed: 17502728]
- Lima VD, Kopec JA. Quantifying the effect of health status on health care utilization using a preference-based health measure. *Social Science & Medicine* 2005;60(3):515–524. [PubMed: 15550300]
- Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *American Journal of Epidemiology* 1993;138(11):923–936. [PubMed: 8256780]
- Marlatt, GA. *Harm Reduction: Pragmatic Strategies for Managing High-Risk Behaviors*. The Guilford Press; New York: 2002.
- Martin I, Lampinen TM, McGhee D. Methamphetamine use among marginalized youth in British Columbia. *Canadian Journal of Public Health* 2006;97(4):320–324.
- May RM, Anderson RM. Transmission dynamics of HIV infection. *Nature* 1987;326(6109):137–142. [PubMed: 3821890]
- McCullagh, P.; Nelder, JA. *Generalized Linear Models*. CRC Press; Boca Raton, FL: 1999.
- Milburn NG, Rotheram-Borus MJ, Rice E, Mallet S, Rosenthal D. Cross-national variations in behavioral profiles among homeless youth. *American Journal of Community Psychology* 2006;37(12):63–76. [PubMed: 16680537]
- Montgomery SB, Hyde J, De Rosa CJ, Rohrbach LA, Ennett S, Harvey SM, Clatts M, Iverson E, Kipke MD. Gender differences in HIV risk behaviors among young injectors and their social network members. *American Journal of Drug and Alcohol Abuse* 2002;28(3):453–475. [PubMed: 12211360]
- Moon MW, Binson D, Page-Shafer K, Diaz R. Correlates of HIV risk in a random sample of street youths in San Francisco. *Journal of the Association of Nurses in AIDS Care* 2001;12(6):18–27. [PubMed: 11723912]
- Moon MW, McFarland W, Kellogg T, Baxter M, Katz M, MacKellar D, Valleroy LA. HIV risk behavior of runaway youth in San Francisco: Age of onset and relation to sexual orientation. *Youth & Society* 2000;32(2):184–201.
- Noell J, Rohde P, Ochs L, Yovanoff P, Alter MJ, Schmid S, Bullard J, Black C. Incidence and prevalence of chlamydia, herpes, and viral hepatitis in a homeless adolescent population. *Sexually Transmitted Diseases* 2001a;28(1):4–10. [PubMed: 11196044]
- Noell J, Rohde P, Seeley J, Ochs L. Childhood sexual abuse, adolescent sexual coercion and sexually transmitted infection acquisition among homeless female adolescents. *Child Abuse & Neglect* 2001b;25(1):137–148. [PubMed: 11214808]
- Ochnio JJ, Patrick D, Ho M, Talling DN, Dobson SR. Past infection with hepatitis A virus among Vancouver street youth, injection drug users and men who have sex with men: Implications for vaccination programs. *Canadian Medical Association Journal* 2001;165(3):293–297. [PubMed: 11517645]
- Petchers MK, Singer MI. Perceived-Benefit-of-Drinking Scale: Approach to screening for adolescent alcohol abuse. *Journal of Pediatrics* 1987;110(6):977–981. [PubMed: 3585614]
- Petchers MK, Singer MI, Angelotta JW, Chow J. Revalidation and expansion of an adolescent substance abuse screening measure. *Journal of Development and Behavioral Pediatrics* 1988;9(1):25–29.
- Pfeifer RW, Oliver J. A study of HIV seroprevalence in a group of homeless youth in Hollywood, California. *Journal of Adolescent Health* 1997;20(5):339–342. [PubMed: 9168380]
- Public Health Agency of Canada. Sexually Transmitted Infections in Canadian Street Youth: 1999-2003. 2006a. Viewed July 6, 2007, <http://www.phac-aspc.gc.ca/std-mts.reports_06/sti-youth_e.html>
- Public Health Agency of Canada. Street Youth In Canada: Findings from Enhanced Surveillance of Canadian Street Youth, 1999-2003. 2006b. Viewed July 6, 2007, <http://www.phac-aspc.gc.ca/std-mts/reports_06/youth_e.html>
- Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977;1(3):385–401.
- Rew L, Fouladi RT, Yockey RD. Sexual health practices of homeless youth. *Journal of Nursing Scholarship* 2002;34(2):139–145. [PubMed: 12078538]
- Rew L, Grady M, Whittaker TA, Bowman K. Interaction of duration of homelessness and gender on adolescent sexual health indicators. *Journal of Nursing Scholarship* 2008;40(2):109–115. [PubMed: 18507564]

- Rhodes T, Kimber J, Small W, Fitzgerald J, Kerr T, Hickman M, Holloway G. Public injecting and the need for 'safer environment interventions' in the reduction of drug-related harm. *Addiction* 2006;101(10):1384–1393. [PubMed: 16968336]
- Rhodes T, Singer M, Bourgois P, Friedman SR, Strathdee SA. The social structural production of HIV risk among injecting drug users. *Social Science & Medicine* 2005;61(5):1026–1044. [PubMed: 15955404]
- Rohde P, Noell J, Ochs L, Seeley JR. Depression, suicidal ideation and STD-related risk in homeless older adolescents. *Journal of Adolescence* 2001;24(4):447–460. [PubMed: 11549325]
- Rosenthal D, Rotheram-Borus MJ, Batterham P, Mallett S, Rice E, Milburn NG. Housing stability over two years and HIV risk among newly homeless youth. *AIDS and Behavior* 2007;11(6):831–841. [PubMed: 17497219]
- Rothman, KJ.; Greenland, S. *Modern Epidemiology*. Lippincott Williams & Wilkins; New York: 1998.
- Roy E, Haley N, Leclerc P, Boivin JF, Cedras L, Vincelette J. Risk factors for hepatitis C virus infection among street youths. *Canadian Medical Association Journal* 2001;165(5):557–560. [PubMed: 11563207]
- Roy E, Haley N, Leclerc P, Cedras L, Blais L, Boivin JF. Drug injection among street youths in Montreal: Predictors of initiation. *Journal of Urban Health* 2003a;80(1):92–105. [PubMed: 12612099]
- Roy E, Haley N, Leclerc P, Cedras L, Weber AE, Claessens C, Boivin JF. HIV incidence among street youth in Montreal, Canada. *AIDS* 2003b;17(7):1071–1075. [PubMed: 12700458]
- Roy E, Haley N, Leclerc P, Lemire N, Boivin JF, Frappier JY, Claessens C. Prevalence of HIV infection and risk behaviours among Montreal street youth. *International Journal of STD & AIDS* 2000;11(4):241–247. [PubMed: 10772087]
- Roy E, Haley N, Lemire N, Boivin JF, Leclerc P, Vincelette J. Hepatitis B virus infection among street youths in Montreal. *Canadian Medical Association Journal* 1999;161(6):689–693. [PubMed: 10513274]
- Rushton JL, Forcier M, Schectman RM. Epidemiology of depressive symptoms in the National Longitudinal Study of Adolescent Health. *Journal of the American Academy of Child and Adolescent Psychiatry* 2002;41(2):199–205. [PubMed: 11837410]
- Scott A, Ellen J, Clum G, Leonard L. HIV and housing assistance in four U.S. cities: Variations in local experience. *AIDS and Behavior* 2007;11(Suppl 2):S140–S148.
- Shalwitz, J.; Goulart, M.; Dunnigan, K.; Flannery, D. Prevalence of sexually transmitted diseases (STD) and HIV in a homeless youth medical clinic in San Francisco (S.F.). VI International Conference on AIDS; San Francisco. June 20-23; 1990. S.C.571 no. S.C.571
- Shields SA, Wong T, Mann J, Jolly AM, Haase D, Mahaffey S, Moses S, Morin M, Patrick DM, Predy G, Rossi M, Sutherland D. Prevalence and correlates of Chlamydia infection in Canadian street youth. *Journal of Adolescent Health* 2004;34(5):384–390. [PubMed: 15093792]
- Shinn M, Weitzman BC, Stojanovic D, Knickman JR, Jimenez L, Duchon L, James S, Krantz DH. Predictors of homelessness among families in New York City: From shelter request to housing stability. *American Journal of Public Health* 1998;88(11):1651–1657. [PubMed: 9807531]
- Shoveller JA, Johnson JL, Savoy DM, Pietersma WAW. Preventing sexually transmitted infections among adolescents: An assessment of ecological approaches and study methods. *Sex Education* 2006;6(2):163–183.
- Small W, Rhodes T, Wood E, Kerr T. Public injection settings in Vancouver: Physical environment, social context and risk. *International Journal of Drug Policy* 2007;18(1):27–36. [PubMed: 17689341]
- Smith KW, McGraw SA, Costa LA, McKinlay JB. A self-efficacy scale for HIV risk behaviors: Development and evaluation. *AIDS Education and Prevention* 1996;8(2):97–105. [PubMed: 8727650]
- Solorio MR, Milburn NG, Rotheram-Borus MJ, Higgins C, Gelberg L. Predictors of sexually transmitted infection testing among sexually active homeless youth. *AIDS and Behavior* 2006;10(2):179–184. [PubMed: 16479414]
- Solorio MR, Rosenthal D, Milburn NG, Weiss RE, Batterham PJ, Gandara M, Rotheram-Borus MJ. Predictors of sexual risk behaviors among newly homeless youth: A longitudinal study. *Journal of Adolescent Health* 2008;42(4):401–409. [PubMed: 18346666]

- Somlai AM, Kalichman SC, Bagnall A. HIV risk behaviour among men who have sex with men in public sex environments: An ecological evaluation. *AIDS Care* 2001;13(4):503–514. [PubMed: 11454271]
- Stoltz JA, Shannon K, Kerr T, Zhang R, Montaner JS, Wood E. Associations between childhood maltreatment and sex work in a cohort of drug-using youth. *Social Science & Medicine* 2007;65(6):1214–1221. [PubMed: 17576029]
- Ver Hoef JM, Boveng PL. Quasi-Poisson vs. negative binomial regression: How should we model overdispersed count data? *Ecology* 2007;88(11):2766–2772. [PubMed: 18051645]
- Vickerman P, Watts C. Injecting drug use and the sexual transmission of HIV: Simple model insights. *International Journal of Drug Policy* 2003;14(1):89–93.
- Weber AE, Boivin JF, Blais L, Haley N, Roy E. HIV risk profile and prostitution among female street youths. *Journal of Urban Health* 2002;79(4):525–535. [PubMed: 12468672]
- Weber AE, Boivin JF, Blais L, Haley N, Roy E. Predictors of initiation into prostitution among female street youths. *Journal of Urban Health* 2004;81(4):584–595. [PubMed: 15466840]
- Weir BW, Bard RS, O'Brien K, Casciato CJ, Stark MJ. Uncovering patterns of HIV risk through multiple housing measures. *AIDS and Behavior* 2007;11(Suppl 2):S31–S44.
- Wolitski RJ, Kidder DP, Fenton KA. HIV, homelessness, and public health: Critical issues and a call for increased action. *AIDS and Behavior* 2007;11(Suppl 2):S167–S171.
- Wood E, Stoltz JA, Montaner JS, Kerr T. Evaluating methamphetamine use and risks of injection initiation among street youth: The ARYS study. *Harm Reduction Journal* 2006;3:18. [PubMed: 16723029]
- Zanetta DM, Strazza L, Azevedo RS, Carvalho HB, Massad E, Menezes RX, Ferreira DP, Burattini MN. HIV infection and related risk behaviours in a disadvantaged youth institution of Sao Paulo, Brazil. *International Journal of STD & AIDS* 1999;10(2):98–104. [PubMed: 10215114]
- Zimet GD, Sobo EJ, Zimmerman T, Jackson J, Mortimer J, Yanda CP, Lazebnik R. Sexual behavior, drug use, and AIDS knowledge among Midwestern runaways. *Youth & Society* 1995;26(4):450–462.

Table 1

Sociodemographic characteristics and sexual behaviours of street-involved youth in Vancouver, Canada ($n = 529$).

Characteristic	
Age (mean, SD)	22 (2.8)
Female (n, %)	159 (30.1)
Aboriginal ethnicity (n, %)	127 (24.0)
LGBT ^a (n, %)	69 (13.0)
Housing status (n, %)	
Apartment/house/SRO ^b	201 (38.0)
Shelter/hostel	119 (22.5)
NFA ^c /street	196 (37.1)
Sexual activity [†] (n, %)	415 (78.4)
Number of sex partners [†] (median, IQR)	1 (1-3)
Consistent condom use [‡] (n, %)	127 (30.6 [‡])

Note:

^aLGBT denotes lesbian, gay, bisexual or transgendered /transsexual;

^bSRO denotes single room occupancy hotel;

^cNFA denotes no fixed address;

[†]refers to activities in the past 6 months;

[‡]among sexually active participants.

Table 2
Factors associated with number of sex partners among a cohort of street-involved youth (n = 529).

Characteristic	Unadjusted Incidence Rate Ratio (IRR)			Adjusted Incidence Rate Ratio (aIRR)		
	IRR	(95% CI)	p - value	aIRR	(95% CI)	p - value
Age (per year older)	0.98	(0.93 – 1.04)	0.566	0.99	(0.95 – 1.04)	0.693
Sex (female vs. male)	0.80	(0.57 – 1.13)	0.198	0.65	(0.49 – 0.87)	0.004
Aboriginal ethnicity (yes vs. no)	0.84	(0.58 – 1.22)	0.366	0.75	(0.56 – 0.99)	0.043
Sexual orientation (LGBTB ^d vs. heterosexual)	1.90	(1.37 – 2.63)	<0.001	1.75	(1.29 – 2.36)	<0.001
Housing (ref: apt./house/SRO ^b)						
shelter/hostel	1.65	(1.12 – 2.43)	0.012	1.44	(1.09 – 1.90)	0.010
NFA ^c /street	1.40	(0.98 – 2.01)	0.065	1.21	(0.93 – 1.57)	0.149
Relationship (single vs. partner)	1.79	(1.19 – 2.69)	0.005	1.13	(0.83 – 1.53)	0.440
Depression (yes [*] vs. no)	1.14	(0.84 – 1.56)	0.402			
Self-Efficacy LHRB ^d (low vs. high)	1.55	(1.14 – 2.13)	0.006	1.19	(0.96 – 1.49)	0.119
Condom Use [†] (ref: always)						
sometimes/occasionally	1.52	(1.10 – 2.10)	0.010	1.28	(0.98 – 1.67)	0.065
never	0.56	(0.35 – 0.90)	0.015	0.46	(0.31 – 0.68)	<0.001
Anal Intercourse [†] (yes vs. no)	2.52	(1.83 – 3.48)	<0.001	1.47	(1.13 – 1.91)	0.004
Sexual Abuse [‡] (yes vs. no)	1.67	(1.25 – 2.24)	<0.001	1.40	(1.09 – 1.79)	0.008
Drug Dealing [†] (yes vs. no)	1.30	(0.95 – 1.77)	0.104			
Alcohol Dependence (yes vs. no)	1.32	(0.97 – 1.79)	0.073	1.07	(0.86 – 1.34)	0.549
Crack Use [†] (yes vs. no)	1.45	(1.07 – 1.98)	0.018	1.46	(1.14 – 1.87)	0.003
Cocaine Use [†] (yes vs. no)	1.62	(1.20 – 2.19)	0.002	1.39	(1.10 – 1.74)	0.005
Heroin Use [†] (yes vs. no)	0.99	(0.72 – 1.37)	0.952			
Crystal Meth Use [†] (yes vs. no)	1.07	(0.79 – 1.44)	0.671			
Injection Drug Use [†] (yes vs. no)	1.01	(0.73 – 1.40)	0.944			
Sharing Syringes [†] (yes vs. no)	1.17	(0.72 – 1.91)	0.521			

Note:

^a LGBTT denotes lesbian, gay, bisexual or transgendered/transsexual;

^b SRO denotes single room occupancy hotel;

^c NFA denotes no fixed address;

d denotes self-efficacy for limiting HIV risk behaviours scale;

* CES-D standard cut-off score of 16 or greater;

τ refers to activities in the past 6 months;

$\#$ refers to lifetime history.

Table 3

Factors associated with consistent condom use among a cohort of sexually active street-involved youth (n = 415).

Characteristic	Consistent n (%) n = 127	Inconsistent n (%) n = 288	Odds Ratio (95% CI)	p - value
Age				
< 22	61 (27.4)	162 (72.6)	0.72 (0.47 – 1.09)	0.150
≥22	66 (34.4)	126 (65.6)		
Sex				
Female	36 (27.5)	95 (72.5)		
Male	90 (31.6)	192 (68.1)	0.81 (0.51 – 1.28)	0.426
Aboriginal Ethnicity				
Yes	37 (35.6)	67 (64.4)		
No	90 (28.9)	221 (71.1)	1.36 (0.85 – 2.17)	0.251
Sexual Orientation				
LGBT ^a	9 (17.0)	44 (83.0)		
Heterosexual	117 (32.5)	243 (67.5)	0.42 (0.20 – 0.90)	0.033
Housing				
Apt./House/SRO ^b	57 (36.5)	99 (63.5)		
Shelter/Hostel	32 (34.8)	60 (65.2)	0.93 (0.54 – 1.59)	0.777*
NFA ^c /Street	38 (24.5)	117 (75.5)	0.56 (0.35 – 0.92)	0.021*
Relationship Status				
Single/Dating	105 (35.2)	193 (64.8)		
Regular Partner	20 (17.9)	92 (82.1)	2.50 (1.46 – 4.30)	0.001
Depression [◇]				
Yes	63 (29.2)	153 (70.8)		
No	60 (32.6)	124 (67.4)	0.98 (0.64 – 1.49)	0.526
Self Efficacy LHRB ^d				
Low	46 (26.3)	129 (73.7)		
High	79 (34.6)	149 (65.4)	0.67 (0.44 – 1.04)	0.091
Number of Sex Partners [†]				
> 1	79 (32.4)	165 (67.6)		
≤1	48 (28.1)	123 (71.9)	1.23 (0.80 – 1.88)	0.407
Anal Intercourse [†]				
Yes	12 (16.9)	59 (83.1)		
No	111 (33.2)	223 (66.8)	0.41 (0.21 – 0.79)	0.010
Sexual Abuse [‡]				
Yes	33 (29.5)	79 (70.5)		
No	91 (30.6)	206 (69.4)	0.95 (0.59 – 1.52)	0.912
Drug Dealing [†]				
Yes	71 (28.9)	175 (71.1)		
No	56 (33.1)	113 (66.9)	0.82 (0.54 – 1.25)	0.412
Alcohol Dependence				
Yes	56 (26.7)	154 (73.3)		

Characteristic	Consistent n (%) n = 127	Inconsistent n (%) n = 288	Odds Ratio (95% CI)	p - value
No	63 (34.1)	122 (65.9)	0.70 (0.46 – 1.09)	0.137
Crack Use [†]				
Yes	67 (27.8)	174 (72.2)		
No	60 (34.5)	114 (65.5)	0.73 (0.48 – 1.12)	0.177
Cocaine Use [†]				
Yes	58 (29.7)	137 (70.3)		
No	69 (31.4)	151 (68.6)	0.93 (0.61 – 1.41)	0.802
Heroin Use [†]				
Yes	43 (31.6)	93 (68.4)		
No	84 (30.1)	195 (69.9)	1.07 (0.69 – 1.67)	0.842
Crystal Meth Use [†]				
Yes	52 (26.3)	146 (73.7)		
No	75 (34.6)	142 (65.4)	0.67 (0.44 – 1.03)	0.084
Injection Drug Use [†]				
Yes	35 (29.4)	84 (70.6)		
No	92 (31.1)	204 (68.9)	0.92 (0.58 – 1.47)	0.829
Syringe Sharing [†]				
Yes	7 (17.9)	32 (82.1)		
No	120 (31.9)	256 (68.1)	0.47 (0.20 – 1.09)	0.105

Note:

^a LGBTT denotes lesbian, gay, bisexual or transgendered/transsexual;

^b SRO denotes single room occupancy hotel;

^c NFA denotes no fixed address;

^d denotes Self-Efficacy for Limiting HIV Risk Behaviours Scale;

◇ CES-D standard cut-off score of 16 or greater;

[†] refers to activities in the past 6 months;

[‡] refers to lifetime history;

* overall p-value is 0.077.

Table 4

Multivariate logistic regression analysis of factors associated with consistent condom use among a cohort of sexually active street-involved youth (n = 415).

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval (95% CI)	p - value
Age			
(< 22 vs. ≥22)	0.81	(0.50 – 1.33)	0.410
Sex			
(female vs. male)	1.07	(0.62 – 1.86)	0.802
Aboriginal Ethnicity			
(yes vs. no)	1.32	(0.77 – 2.27)	0.308
Sexual Orientation			
(LGBT ^a vs. heterosexual)	0.43	(0.19 – 0.98)	0.043
Relationship Status			
(single/dating vs. regular)	3.50	(1.89 – 6.50)	< 0.001
Housing Status (ref: apt./house/SRO ^b)			
shelter/hostel	0.68	(0.37 – 1.27)	0.229
NFA ^c /Street	0.47	(0.27 – 0.82)	0.008
Self-Efficacy LHRB ^d			
(low vs. high)	0.66	(0.40 – 1.08)	0.094
Alcohol Dependence			
(yes. vs. no)	0.67	(0.42 – 1.08)	0.100

Note:

^a LGBTT denotes lesbian, gay, bisexual or transgendered/transsexual;

^b SRO denotes single room occupancy hotel;

^c NFA denotes no fixed address;

^d denotes Self-Efficacy for Limiting HIV Risk Behaviours Scale.