Sex Work as an Emerging Risk Factor for HIV Seroconversion among People who inject drugs in the SurvUDI Network

Karine BLOUIN, Ph.D.^{1,2,3}, Pascale LECLERC, M.Sc.⁴,
Carole MORISSETTE, MD⁴, Elise ROY, MD, M.Sc.^{1,5}, Caty
BLANCHETTE, M.Sc.³, Raymond PARENT, M.Sc.¹, Bouchra
SERHIR, Ph.D.⁶, Michel ALARY, MD, Ph.D.^{1,2,3}

¹Unité des Infections Transmissibles Sexuellement et par le Sang, Institut National de Santé Publique du Québec, Québec, Canada, ² Département de Médecine Sociale et Préventive, Université Laval, ³Axe Santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec - Université Laval, Québec, Canada, ⁴Direction de Santé Publique du Centre intégré universitaire de santé et de service sociaux du Centre-Sud-de-l'Île-de-Montréal, Montréal, Canada, ⁵Université de Sherbrooke à Longueuil, Département des Sciences de la Santé Communautaire, Longueuil, Canada, ⁶Laboratoire de santé publique du Québec, Institut National de Santé Publique du Québec, Sainte-Anne de Bellevue, Canada.

Short summary: Among Central Eastern Canada PWID, sex work was independently associated with HIV incidence. Participants who engaged in sex work were compared with other participants with respect to HIV risks (**word count:** 29).

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Address for correspondence: Michel Alary, MD, PhD, Directeur
Axe Santé des populations et pratiques optimales en santé
Centre de recherche du CHU de Québec
Hôpital du Saint-Sacrement
1050 Chemin Ste-Foy
Québec, Qc, CANADA, G1S 4L8
Tel: 418-682-7387
Fax: 418-682-7949
e-mail: michel.alary@crchudequebec.ulaval.ca

ABSTRACT

Background: Recent analyses have shown an emerging positive association between sex work and HIV incidence among people who inject drugs (PWIDs) in the SurvUDI network.

Methods: Participants who had injected in the past 6 months were recruited across the Province of Quebec and in the city of Ottawa, mainly in harm reduction programs. They completed a questionnaire and provided gingival exudate for HIV antibody testing. The associations with HIV seroconversion were tested with a Cox proportional hazard model using time-dependent covariables including the main variable of interest, sexual activity (sex work; no sex work; sexually inactive). The final model included significant variables and confounders of the associations with sexual activity.

Results: Seventy-two HIV seroconversions were observed during 5 239.2 person-years of follow-up (Incidence rates: total=1.4/100 person-years (py), [95%CI: 1.1-1.7]; sex work=2.5/100 py [1.5-3.6]; no sex work=0.8/100 py [0.5-1.2]; sexually inactive=1.8/100 py [1.1-2.5]). In the final multivariate model, HIV incidence was significantly associated with sexual activity (sex work: adjusted hazard ratio (AHR)=2.19 [1.13-4.25],; sexually inactive: AHR=1.62 [0.92-2.88]), and injection with a needle/syringe used by someone else (AHR=2.84, [1.73-4.66]).

Conclusions: Sex work is independently associated with HIV incidence among PWIDs. At the other end of the spectrum of sexual activity, sexually inactive PWIDs have a higher HIV incidence rate, likely due to more profound dependence leading to increased vulnerabilities, which may include mental illness, poverty and social

69 exclusion. Further studies are needed to understand whether the association
70 between sex work and HIV is related to sexual transmission or other vulnerability
71 factors.

72 **Keywords** : people who inject drugs, HIV incidence, sex work, sexual activity,
73 injection behaviours

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77 **INTRODUCTION**

78 The Joint United Nations Programme on HIV/AIDS and World Health Organization
79 (UNAIDS/WHO) working group on global HIV/AIDS and STI surveillance provide
80 recent updated guidelines for HIV surveillance activities in several epidemiological
81 contexts ¹. In concentrated HIV epidemics, it is recommended to carry out regular
82 biobehavioural surveys in key populations at higher risk for HIV infection in order to
83 understand the local HIV epidemic and how it is changing, as well as to identify
84 opportunities to control the epidemic. These key populations include people who
85 inject drugs (PWIDs), men who have sex with men (MSM) and commercial sex
86 workers as well as their clients, because behaviours that increase the HIV risk are
87 frequent among these populations, i.e. unprotected sex with multiple partners,
88 injection drug use (needle/syringe-sharing) and unprotected anal sex ¹.

89 People who inject drugs are considered at increased risk for HIV infection mainly
90 because of sharing contaminated syringes and other injection paraphernalia. Sexual
91 transmission is possible, but its extent is generally difficult to estimate ². It has been
92 suggested that in PWIDs, sexual risks are present but may be masked or
93 overshadowed by parenteral risks ³. This would be rather likely considering the much
94 higher risk of HIV transmission of needle/syringe-sharing (0.7% per exposure)
95 compared to oral (maximum of 0.06% per exposure) or vaginal sex (maximum of
96 0.15% per exposure), with the exception of anal sex (maximum of 3% per
97 exposure)⁴⁻⁶. Thus, sexual transmission is more likely to occur in specific situations
98 such as in the context of commercial sex trade or male homosexual intercourse i.e.
99 high number of sex partners or frequent anal sex. This in turn may lead to bridging of
100 HIV and other sexually transmitted and blood-borne infection epidemics between

PWIDs, who cumulate risks, and individuals who do not, as for example, persons in the general population ^{7,8}.

Important sex differences exist for sex work and should be taken into account ⁹⁻¹¹. For example, sex work is frequent in PWIDs, but generally much more frequent in female than in male PWIDs ¹¹. It occurs generally in the context of heterosexual sex for women (i.e. very low HIV prevalence in clients in most developed countries) and women are particularly vulnerable to sexual violence and abuse including negotiation of condom use ¹⁰. On the other hand, sex work in men takes place generally in the context of sex with other men (i.e. very high HIV prevalence in clients in most developed countries) ¹².

The SurvUDI network is a biobehavioural survey among PWIDs of Central Eastern Canada, ongoing since 1995. Recent analyses of SurvUDI data have shown an emerging positive association between sex work and HIV incidence among PWIDs ¹³. In this previous analysis, a time period interaction variable was included (1995-2002 vs. 2003-2009) in a multivariate model and the association of sex work with HIV incidence was significant for 2003-2009 but not for 1995-2002. Considering that the questionnaire for the period 2004-2014 includes much more variables than for the period 1995-2002, repeating this analysis for 2004-2014 has allowed a better characterization of participants according to the main variable of interest. The hypothesis was that the association with sex work would be detected for the period 2004-2014. The objectives of the present study were to examine the association between sex work and HIV seroconversion among PWIDs in the SurvUDI network between 2004 and 2014 and to compare participants engaging in sex work with other participants with respect to HIV risks.

METHODS

Study design and subjects. The complete methodology of the SurvUDI study has been described elsewhere ¹⁴. Briefly, the SurvUDI network is an ongoing biobehavioural survey for HIV, HCV and associated risk behaviours among PWIDs in Eastern Central Canada. The network was implemented in 1995 and targets hard-to-reach, mostly out-of-treatment PWIDs. Eligibility criteria include being aged 14 and older, injecting at least once within the past 6 months, speaking French or English and being able to provide informed consent. Participants are recruited in urban areas, including Montréal and neighbouring South Shore, Québec City, the Hull-Ottawa region, and five semi-urban areas of the province of Québec. Overall, since 2004, 94.6% of participants were recruited in harm reduction programs. Others were recruited in drop-in centres, detention centres, detoxification clinics, and rehabilitation programmes. Participation includes an interviewer-administered questionnaire and collection of gingival exudate using the Orasure device (Bethlehem, Pennsylvania, US) for HIV and HCV antibody testing. The study design is an open cohort of services where participants who attend harm reduction programs more than once at times of study enrollment are followed longitudinally. The present sample includes participants recruited from March 2004 to March 31 2014 who were initially HIV seronegative and with at least one follow-up visit. Participants are identified using an encrypted code based on their initials, birth date and sex, and they are given a stipend ranging from CAN\$5.00 to \$10.00 at the end of each study visit. All procedures have been approved by the ethics committee of the Centre de recherche du CHU de Québec.

Study variables. The dependent variable was HIV incidence. HIV infection was set at the midpoint between the last HIV negative follow-up visit and the visit when the HIV positive result was first detected. Potential confounders were identified based on a literature review and on previous analyses in this cohort. Covariates considered in the multivariate analyses as potential confounders included age (<25; ≥25 years)^{13,15,16}, sex^{13,15,16}, the region where the interview took place (urban or semi-urban/rural)¹³, high school completion¹⁷, homelessness^{18,19}, recent incarceration^{15,19}, injected and non injected drug use^{13,20}, cocaine as the most often injected drug¹³, injection with strangers (unknown people)^{14,18}, injection with needles/syringes used by someone else^{13,17}, daily injection^{13,21}, the number of sexual partners¹⁷, consistent condom use for vaginal and anal sex²², always injecting alone and injecting in public places (previous analyses, unpublished data). Sexual activity, the main exposure of interest, was categorized as a three-level variable, namely, being sexually active without engaging in sex work (no sex work, NSW), being sexually active and engaging into sex work (sex work, SW) or being sexually inactive. Sex work was defined as having client sex partners in the past six months, i.e. partners giving money, drugs, goods or other things in exchange for sex. The choice for the reference category (no sex work) was based on the hypothesis that this group would show the lowest risk compared to the other two groups. This assumption was based on previous analyses in our population showing that sexual inactivity in male IDUs was associated with a higher HIV prevalence¹⁴. In the descriptive analyses of participants according to sexual activity, several variables considered relevant were presented even if not retained as confounders in the multivariate analysis. Sexual orientation was added to the questionnaire in February 2011. Questions on

behaviours referred to the 6 months prior to the interview, except for daily injection which refers to the last month.

Laboratory procedures. Collected oral fluid samples were kept at 4°C and shipped within 2 weeks to the Laboratoire de santé publique du Québec (LSPQ; Institut national de santé publique du Québec), where they were centrifuged upon reception. The extracted liquid was kept at -20°C for a maximum of 6 weeks until analysis. The presence of HIV antibodies was assessed by enzyme immunoassay (EIA) using HIV-1 Vironostika Microelisa System (bioMérieux, Durham, North Carolina, USA) from 2004 to 2009 and GS HIV-1/HIV-2 PLUS O EIA (Bio-Rad Laboratories (Canada) Ltd., Montréal, Qc, Canada) thereafter. The presence of HCV antibodies was assessed using ORTHO® HCV 3.0 ELISA Test System (Bio-Rad Laboratories (Canada) Ltd., Montréal, Qc, Canada) according to a modified method developed by Judd *et al.*²³. Samples were considered negative if results were less than 75% of the cut-off value. Sample results that were greater than 75% of the cut-off value were retested in duplicate. A sample was deemed positive if at least two out of three results were greater than the cutoff value.

Statistical analyses. HIV seronegative participants at baseline who had at least one follow-up visit for the period from 2004 to 2014 were considered when assessing HIV incidence rates. Baseline characteristics and behaviours are those reported at the second visit, i.e. exposure during the first time interval in the Cox proportional hazard model. Using the Kaplan-Meier method, we estimated the cumulative probability of seroconversion during follow-up. The cumulative HIV incidence rates were plotted and compared for sexual activity reported at baseline using the log-rank test. Bivariate and multivariate Cox proportional hazard regression analyses were carried

out to evaluate the association between HIV incidence and sexual activity. Behavioural variables and age were treated as time-dependent variables. The exposure used for a given time interval corresponds to the exposure measured at the visit at the end of this interval, i.e. exposure reported for the preceding 6 months. The final model included significant ($p < 0.05$) variables and confounders i.e. variables changing other AHR by 10% or more when removed of the complete model. Effect modification by sex was also tested for the association between sexual activity and HIV incidence, and was considered statistically significant at a p value of 0.15 or less (Wald chi-squared test). To compare risk profiles between participants engaged in sex work and other participants, cross-sectional sex-stratified descriptive analyses were performed using the last visit for non-seroconverters and the visit when HIV infection was first detected for seroconverters. Cross-sectional comparisons were performed using Pearson's chi-squared tests or ANOVA. All analyses were carried out using the SAS statistical suite software version 9.4 (SAS Institute Inc., Cary, North Carolina, USA).

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214 **RESULTS**

215 Table 1 shows baseline characteristics of participants. The sample included 1 528
216 participants cumulating 5 239.2 person-years of follow-up, with a majority of men and
217 of subjects from urban sites. Only a small proportion of PWIDs were less than 25
218 years old. Homelessness as well as cocaine as the most often injected drug were
219 frequently reported. Sex work was more frequently observed in women whereas
220 sexual inactivity was more frequent in men.

221 Figure 1 shows cumulative hazard of HIV seroconversion and HIV incidence
222 according to baseline sexual activity for the ten-year period (2004-2014). Occurrence
223 of seroconversions was proportionally distributed throughout the follow-up period in
224 all groups. A statistically significant difference was observed between groups, with
225 the highest cumulative hazard observed in participants who reported sex work
226 ($p<0.0001$). The highest HIV incidence rate was observed in participants who
227 reported sex work (more than three-fold higher compared to sexually active
228 participants who did not report sex work), followed by HIV incidence rate in sexually
229 inactive individuals.

230 In the final multivariate model (Table 2), the association of HIV incidence with sex
231 work is the second strongest with an adjusted incidence rate ratio of 2.19 [1.13-4.25].
232 The strongest association was observed for injection with a needle/syringe used by
233 someone else (AHR=2.84, [1.73-4.66]). Effect modification analyses showed that the
234 association between HIV incidence and sexual activity did not vary significantly
235 according to sex (p -value for effect modification=0.5729). Sex-stratified rate ratios
236 are presented in table 2.

Tables 3 and 4 show cross-sectional, sex-stratified analyses of injection and sex behaviours according to sexual activity. Male SW (Table 3) were significantly younger and more likely to be homeless and to report a history of incarceration in the past 6 months compared to other groups. Male SW were also significantly more likely to use heroin by injection, to report cocaine as the most often injected drug and to use non-injected crack/freebase, amphetamines and ecstasy. Male SW were significantly more likely to inject with strangers and to inject with needles/syringes used by someone else obtained mainly from strangers compared to male NSW. A large proportion of male SW had sex with at least 6 male sex partners in the past 6 months (41.2%) and reported at least one female sex partner (58.8%). Among male SW who had multiple male sex partners, 72% reported heterosexual or bisexual orientation (data not shown). The proportion of men who reported inconsistent condom use for vaginal or anal sex is high (sex work=42.6%, no sex work=62.7%). Sexually inactive men were significantly more likely to report daily injection and to always inject alone compared to other groups. Male SW and sexually inactive men were more likely to report injection with needles/syringes used by someone else obtained mainly from strangers compared to male NSW. HCV prevalence (positivity for HCV antibodies) was significantly higher in male SW compared to other groups (intermediate in sexually inactive men).

Female SW (Table 4) were more likely to be homeless and to report a history of incarceration in the past 6 months compared to other groups. They were also significantly more likely to use injected cocaine, to report cocaine as their most often injected drug and to use non-injected crack/freebase and ecstasy. Female SW were more likely to report injection with strangers and injection with a needle/syringe used by someone else obtained mainly from strangers. The majority of women were

sexually active. Among female NSW, 25.3% reported at least two male sex partners in the past six months. Approximately half of female SW had sex with at least 21 male partners in the past six months (48.1%). A high proportion of women reported inconsistent condom use for vaginal or anal sex (sex work=60.9%, no sex work=84.1%). Sexually inactive women were significantly more likely to always inject alone. HCV prevalence (positivity for HCV antibodies) was significantly higher in female SW compared to the other groups.

DISCUSSION

The objectives of the present study were 1) to characterize the association between sex work (i.e reporting client sex partners) and HIV seroconversion among PWIDs in the SurvUDI network between 2004 and 2014 and 2) to describe the characteristics and risk profile of participants who reported sex work in the past 6 months. The highest HIV incidence rate was observed in participants who reported sex work. In the multivariate analysis, sex work and injection with a needle used by someone else were significantly and independently associated with HIV incidence. Both male and female PWIDs who reported sex work were more frequently in situation of homelessness and reported more unsafe injecting as well as sexual behaviours.

In the present study, the association between HIV incidence and sexual activity did not show significant effect modification by sex. Although the direction of the association is the same for men and women, the association observed in men is not significant and is weaker than in women. This is not surprising given the small number of men reporting client sex partners. Thus, it is not clear whether the absence of a significant modifying effect by sex, as well as the absence of a significant association among men in the sex-specific analyses, are due to a lack of power (inability to detect an existing effect modification that could show an association among women only) or to the absence of modifying effect.

Recently, Kerr *et al.*¹⁵ also observed a significant association between sex work and HIV incidence in Vancouver PWIDs (men and women combined), but it did not remain significant in multivariate analysis. A methodological issue that may explain differences with the present study is the definition of the reference category for the

sex work variable. Kerr *et al.* ¹⁵ defined sex work as a dichotomous variable where «no sex work» presumably included sexually inactive individuals. As observed in the present study, sexually inactive PWIDs may differ from other participants in their characteristics as well as their drug use risk patterns. In the present study, compared to sexually active male who did not report sex work, sexually inactive male were significantly more likely to report daily injection and injection with needles/syringes used by someone else obtained mainly from strangers. Sexually inactive participants may have a more profound dependence associated to increased vulnerabilities, which may include mental illness, poverty and social exclusion. This could have confounded the association observed in the above-mentioned study. Several other studies have examined the link between sex work or sexual risk profile and HIV transmission in PWIDs of developed countries ^{16,17,24-29}. Most of these studies reported very similar findings i.e associations with homelessness, incarceration, cocaine injection and crack use.

Unprotected sex with multiple partners, including unprotected anal sex ³⁰, are common among the participants of our study. It is difficult to estimate the relative contribution of unsafe injection and sexual behaviours to the transmission of HIV. Vickerman *et al.* ² have recently proposed a deterministic mathematical model to estimate the proportion of HIV infections due to sexual transmission in PWIDs populations. In this model, the HCV prevalence in HIV-infected PWIDs and the HIV/HCV prevalence ratio are used as markers of sexual transmission.

Several authors have suggested that in PWIDs, sexual risks are present but may be masked by parenteral risks ³. This may be an explanation why sex work was not significantly associated with HIV incidence in PWIDs of the SurvUDI network for the

period 1995-2002 while a positive association emerged afterward ¹³. Similar findings were obtained in at least another recent study performed in MSM-PWIDs in San Francisco ¹⁷. In that study, it was suggested that an independent association with sex work had emerged as a result of an “unmasking” effect, with the prevalence of needle-sharing declining. This may also be a plausible hypothesis in the present situation as needle/syringe-sharing in the SurvUDI network significantly decreased from 1995 to 2014 (data not shown), with large-scale implementation of harm reduction programs on the whole territory during that period.

In some studies, authors suggested that the association frequently observed between HIV transmission and crack use may be explained by higher-risk sexual behaviours in crack users ^{28,31}. This is consistent with the present data where participants of both sexes who reported sex work were also significantly more likely to use non injected crack. Interestingly, men who reported sex work were significantly more likely to report non injected use of amphetamines (similar observation in women, but not significant) and women who reported sex work were more likely to use ecstasy. Regardless of whether they reported sex work or not, sexually active men also reported frequent use of ecstasy. Men who reported sex work were slightly more likely to report methamphetamine use, but this was not significant. The complex relationships between drug use and sexual behaviours have been discussed previously ³². Amphetamine-like drugs, including ecstasy, are known to be typically used during sexual activities and to be associated with unsafe sexual activities ³².

The present study may provide several indications to target local public health interventions. First, most participants who reported sex work are women, more likely

homeless and reporting frequent unsafe injecting as well as sexual behaviours. Several authors^{9,33} have suggested that public health interventions should be developed to reduce vulnerabilities among female PWIDs who engage in sex work. A multilevel, combined approach has been proposed⁹, which includes individual and social harm reduction initiatives, biomedical, as well as structural interventions i.e addressing homelessness, mental health and poverty issues as well as supporting legal reform for sex workers to reduce the risk of bloodborne infections, violence and homicide death²⁹. Some authors also reported that HIV prevention programs may be inadequate for MSM/PWIDs^{26,27}. In the present study, men who reported client sex partners had multiple male sex partners, but most of them said that their sexual orientation was heterosexual or bisexual. Consequently, these men are very unlikely to be reached by interventions targeting MSM whereas interventions targeting PWIDs may not be adapted to their high risk sexual exposure^{26,27}. Despite the fact that PWIDs/MSM/sex workers represent a very small population, targeting interventions to this population should be a priority considering their potential for a high level of effectiveness and the possibility of bridging HIV and HCV epidemics between PWIDs and MSM, as well as between male PWIDs reporting sex work and their female sex partners^{34,35}.

The data obtained through the SurvUDI network have some limitations. First, participants are not representative of all PWIDs. They are probably more representative of those who frequent harm reduction programs, where approximately 90% of participants were recruited. Moreover, participants who returned differ slightly from those with a single visit¹³. Participants who returned may have more at risk behaviours, and this could have overestimated the association with sex work. Second, self reporting of behaviours may involve social desirability and recall biases

367 that may lead to over-reporting of protective behaviours, like condom use, and
368 underreporting of high risk behaviours, like syringe-sharing, possibly reducing the
369 strength of the observed associations with HIV incidence.

370 In conclusion, further studies are needed to understand whether the independent
371 association between HIV incidence and sex work is related to sexual transmission or
372 other vulnerability factors, which may include mental illness, poverty and social
373 exclusion, but increased risk due to sexual transmission cannot be excluded.

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- 490

491

FIGURE HEADINGS

Figure 1: Cumulative hazard of HIV seroconversion and HIV incidence according to baseline sexual activity, 2004-2014. Incidence rate calculation based on the sexual activity status reported at the second visit (baseline), i.e. exposure during the first time interval in the Cox proportional hazard model; Sexual activity is missing for 5 participants; Sexually active who did not report sex work; py: person-years.

Table 1: Baseline¹ characteristics and behaviours of participants, 2004-2014

Characteristics and behaviours n (%)	Men (n=1 147)	Women (n=378)	Total (n=1 528) ²
Number of visits, median (min-max)	3 (2-18)	3 (2-14)	3 (2-18)
Age, mean $\pm$ SD	37.8 $\pm$ 10.1	32.9 $\pm$ 9.5	36.6 $\pm$ 10.1
Age (< 25 years)	113 (9.9)	88 (23.3)	201 (13.2)
High school completed	563 (49.4)	203 (54.0)	769 (50.7)
Urban recruitment region	1 027 (89.5)	322 (85.2)	1 352 (88.5)
Homelessness	506 (44.2)	134 (35.6)	640 (42.0)
History of incarceration	168 (14.7)	31 (8.2)	200 (13.1)
Cocaine as the most often injected drug	608 (53.3)	173 (46.0)	783 (51.6)
Injection with a needle/syringe used by someone else	234 (20.6)	110 (29.4)	344 (22.8)
Daily injection ³	405 (35.4)	145 (38.5)	550 (36.1)
Injection with strangers	402 (35.1)	134 (35.6)	536 (35.2)
Time since first injection ($\geq$ 6 years)	873 (76.2)	249 (66.4)	1 125 (73.9)
Sexual activity			
No sex work ⁴	709 (61.9)	181 (48.3)	891 (58.5)
Sex work	76 (6.6)	151 (40.3)	229 (15.0)
Sexually inactive	360 (31.4)	43 (11.5)	403 (26.5)

¹ Baseline characteristics based on information reported at the second visit, i.e. exposure during the first time interval in the Cox proportional hazard model.

² Sex is missing for 3 participants

³ In the last month

⁴ Sexually active who did not report sex work

Table 2: Multivariate analysis¹ of the associations between HIV incidence and sexual activity, 2004-2014

	<i>Crude HR</i>	<i>95% CI²</i>	<i>AHR</i>	<i>95% CI²</i>
<i>Model without effect modification</i>				
<i>Socio-demographic variables</i>				
Sex (men vs women)	0.61	[0.37-1.02]	0.83	[0.45-1.51]
<i>Injection behaviours</i>				
Injection with a needle/syringe used by someone else	3.04	[1.87-4.93]	2.84	[1.73-4.66]
<i>Sexual activity</i>				
No sex work ³	1.00		1.00	
Sex work	2.81	[1.55-5.10]	2.19	[1.13-4.25]
Sexually inactive	1.48	[0.84-2.60]	1.62	[0.92-2.88]
<i>Model with effect modification by sex⁴</i>				
<i>Injection behaviours</i>				
Injection with a needle/syringe used by someone else	3.04	[1.87-4.93]	2.91	[1.77-4.77]
<i>Sexual activity</i>				
No sex work	1.00		1.00	
Sex work, women	3.50	[1.26-9.72]	3.31	[1.19-9.21]
Sexually inactive, women	2.40	[0.57-10.04]	2.86	[0.67-12.01]
Sex work, men	1.87	[0.64-5.41]	1.64	[0.56-4.77]
Sexually inactive, men	1.37	[0.74-2.53]	1.47	[0.80-2.73]

¹ Cox proportional hazard regression model; analysis performed using n=1 362 participants, excluding those with missing values for any of the independent variables

² 95 % confidence intervals

³ Sexually active who did not report sex work

⁴ p-value=0.5729 for effect modification, Wald chi-square test

HR: hazard ratio; AHR: adjusted hazard ratio

Table 3: Characteristics and, injection and sex behaviours according to reported sexual activity in men¹, 2004-2014

Characteristics and behaviours n (%)	No sex work ² (n=656)	Sex work (n=51)	Sexually inactive (n=438)	p-value
Age, mean $\pm$ SD	38.3 $\pm$ 10.1	35.6 $\pm$ 10.0	42.4 $\pm$ 9.7	<0.0001
Age (<25 years)	56 (8.5)	6 (11.8)	16 (3.7)	0.0030
Urban recruitment region	582 (88.7)	47 (92.2)	397 (90.6)	0.4936
Homelessness	263 (40.2)	30 (60.0)	175 (40.1)	0.0200
History of incarceration	87 (13.3)	14 (28.0)	59 (13.5)	0.0142
Drugs used by injection				
Cocaine	518 (79.1)	44 (86.3)	328 (75.1)	0.0975
Heroin	206 (31.5)	19 (37.3)	110 (25.2)	0.0366
Dilaudid® (prescribed or not)	296 (45.2)	27 (52.9)	207 (47.6)	0.4707
Cocaine as the most often injected drug	325 (49.9)	34 (68.0)	224 (52.0)	0.0450
Non-injected drugs				
Crack/freebase	420 (64.0)	43 (84.3)	255 (58.2)	0.0007
Amphetamines	241 (36.7)	28 (54.9)	102 (23.3)	<0.0001
Methamphetamine	41 (6.3)	5 (9.8)	18 (4.1)	0.1302
Ecstasy	127 (19.4)	11 (21.6)	29 (6.6)	<0.0001
Dilaudid® (prescribed or not)	163 (24.9)	12 (23.5)	74 (17.0)	0.0083
Daily injection ³	190 (29.1)	17 (34.7)	184 (42.2)	<0.0001
Time since first injection ($\geq$ 6 years)	542 (82.9)	44 (86.3)	371 (84.9)	0.5975
Injection with strangers	178 (27.3)	24 (47.1)	110 (25.2)	0.0042
Always injected alone	188 (28.8)	13 (25.2)	185 (42.4)	<0.0001
Injection in public places	368 (56.2)	35 (68.6)	248 (56.6)	0.2219
Injection with a needle/syringe used by someone else	119 (18.3)	12 (23.5)	62 (14.3)	0.0960
Injection with needles/syringes used by someone else obtained mainly from strangers	20 (3.1)	3 (6.0)	28 (6.5)	0.0291
Number of female sex partners				
0	32 (4.9)	21 (41.2)	438 (100)	-
1	363 (55.3)	8 (15.7)	0	
2-5	224 (34.2)	15 (29.4)	0	
6-20	33 (5.0)	5 (9.8)	0	
$\geq$ 21	4 (0.6)	2 (3.9)	0	
Number of male sex partners				
0	607 (92.5)	11 (21.6)	438 (100)	-
1	30 (4.6)	8 (15.7)	0	
2-5	14 (2.1)	11 (21.6)	0	
6-20	4 (0.6)	7 (13.7)	0	
$\geq$ 21	1 (0.2)	14 (27.5)	0	
Condom use				
Consistent use for vaginal or anal sex	207 (32.2)	8 (17.0)	-	-
Inconsistent use for vaginal or anal sex	403 (62.7)	20 (42.6)	-	
Oral sex only	33 (5.1)	19 (40.4)	-	
Positivity for HCV antibodies	460 (70.1)	45 (88.2)	340 (77.6)	0.0012

¹ Analyses performed using the last visit for non-seroconverters and the visit when HIV infection was first detected for seroconverters² Sexually active who did not report sex work³ In the last month

NS : non-significant

Table 4: Characteristics and, injection and sex behaviours according to reported sexual activity in women¹, 2004-2014

Characteristics and behaviours n (%)	No sex work ² (n=198)	Sex work (n=129)	Sexually inactive (n=46)	p-value
Age, mean $\pm$ SD	33.5 $\pm$ 10.0	34.4 $\pm$ 8.6	40.5 $\pm$ 10.7	<0.0001
Age (< 25 years)	46 (23.2)	15 (11.6)	3 (6.5)	0.0031
Urban recruitment region	168 (84.9)	106 (82.2)	44 (95.7)	0.0838
Homelessness	59 (30.0)	53 (41.4)	11 (23.9)	0.0365
History of incarceration	11 (5.6)	18 (14.1)	1 (2.2)	0.0068
Drugs used by injection				
Cocaine	132 (66.7)	112 (87.5)	25 (54.4)	<0.0001
Heroin	75 (37.9)	49 (38.3)	10 (21.7)	0.0977
Dilaudid® (prescribed or not)	98 (49.8)	66 (51.6)	21 (46.7)	0.8479
Cocaine as the most often injected drug	80 (40.8)	71 (55.5)	15 (33.3)	0.0085
Non-injected drugs				
Crack/freebase	113 (57.1)	92 (71.3)	23 (50.0)	0.0091
Amphetamines	64 (32.3)	51 (39.5)	14 (30.4)	0.3337
Methamphetamine	8 (4.0)	3 (2.3)	3 (6.5)	0.4171
Ecstasy	29 (14.7)	29 (22.5)	4 (8.7)	0.0540
Dilaudid® (prescribed or not)	31 (15.7)	30 (23.6)	6 (13.3)	0.1289
Daily injection ³	76 (38.8)	55 (42.6)	15 (32.6)	0.4756
Time since first injection ($\geq$ 6 years)	144 (72.7)	109 (84.5)	39 (84.8)	0.0216
Injection with strangers	51 (25.9)	49 (38.6)	3 (6.5)	0.0001
Always injected alone	38 (19.3)	23 (18.1)	18 (39.1)	0.0069
Injection in public places	98 (49.5)	74 (57.8)	18 (39.1)	0.0762
Injection with a needle/syringe used by someone else	57 (28.9)	44 (34.9)	3 (6.5)	0.0011
Injection with needles/syringes used by someone else obtained mainly from strangers	6 (3.1)	11 (8.8)	0 (0.0)	0.0166
Number of female sex partners				
0	169 (85.4)	105 (82.0)	46 (100)	-
1	20 (10.1)	11 (8.6)	-	
2-5	9 (4.6)	8 (6.3)	-	
6-20	0 (0.0)	4 (3.1)	-	
$\geq$ 21	0 (0.0)	0 (0.0)	-	
Number of male sex partners				
0	11 (5.6)	0 (0.0)	46 (100)	-
1	136 (69.0)	4 (3.1)	-	
2-5	44 (22.3)	29 (22.5)	-	
6-20	5 (2.5)	34 (26.4)	-	
$\geq$ 21	1 (0.5)	62 (48.1)	-	
Condom use				
Consistent use for vaginal or anal sex	26 (13.3)	42 (32.8)	-	
Inconsistent use for vaginal or anal sex	164 (84.1)	78 (60.9)	-	
Oral sex only	5 (2.6)	8 (6.3)	-	
Positivity for HCV antibodies	139 (70.2)	107 (83.0)	32 (69.6)	0.0252

¹ Analyses performed using the last visit for non-seroconverters and the visit when HIV infection was first detected for seroconverters

² Sexually active who did not report sex work;

³ In the last month

NS : non-significant

	Number of participants	Seroconversions	Follow-up (py)	HIV incidence rate per 100 py [95 % confidence intervals]
Total	1 528	72	5 239.2	1.4 [1.1-1.7]
Sexual activity				
No sex work	891	25	2 965.1	0.8 [0.5-1.2]
Sex work	229	23	902.5	2.5 [1.5-3.6]
Sexually inactive	403	24	1 349.3	1.8 [1.1-2.5]