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Brief communication (Original)

Human immunodeficiency virus infection and related risk behavior in people who inject drugs in Nepal

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Background: Injecting drugs is major driver of human immunodeficiency virus (HIV) infections in Nepal.
Objectives: To estimate the HIV prevalence and to examine factors associated with it among people who inject (illicit) drugs (PWID) in Nepal.
Methods: The present study was based on data secondary to Integrated Biological and Behavioral Surveillance (IBBS) surveys of PWID in Nepal from 2002 to 2015. A χ^2 test was used to determine significant risk factors for HIV infection. A logistic regression model was used to identify the most important determinants for HIV infection.
Results: We included cross-sectional data from 7,073 PWID in the surveys from 2002 to 2015 in this retrospective observational study; among these 1,257 (17.8%) had tested HIV positive. The prevalence of HIV infection showed a sharp decrease from 2002 (68%) to 2015 (6.2%). After adjusting each factor for the confounding effects of other factors, year, region, age, education, and duration of injecting drugs were significantly associated with HIV ($P < 0.001$). Prevalence of HIV infection was highest for the following factors: year 2002, Kathmandu Region (30.5%), aged ≥30 years (32%), illiterate (28.5%), and injecting drugs >10 years (35%).
Conclusions: HIV infection shows a steady decreasing trend, but the number of cases remains high. The factors strongly contributing to HIV were advanced age, Kathmandu region, low educational achievement, and longer duration of injecting drugs. Intensified and focused programs are needed to reduce the HIV in the region focusing on its associated risk behaviors.

Keywords: Drug users, HIV, IBBS, Nepal

Globally, around 16 million people inject (illicit) drugs and 3 million of them are living with human immunodeficiency virus (HIV) infection. On average, 1 of every 10 new HIV infections worldwide is caused by injecting drugs using contaminated apparatus. People Who Inject Drugs (PWID) are at a high risk of HIV infection, and are increasingly targeted to prevent the spread of HIV [1]. In Nepal, the HIV epidemic among PWID is severe [2, 3].

Nepal is recognized as a country facing a concentrated HIV epidemic. The National Centre for AIDS and STD Control (NCASC) has estimated that there were 39,281 people living with HIV (PLHIV) in Nepal in 2015, with adult HIV prevalence of 0.20% [4]. The National HIV and AIDS Strategy (2011−2016) identifies PWID as a key affected population (KAP) at high risk of HIV infection. Evidence from the various rounds of Integrated Biological and Behavioral Surveillance (IBBS) surveys conducted in Nepal suggests that HIV prevalence is still high among the PWID relative to other KAPs, such as female sex workers (FSW) and men who have sex with men (MSM), immigrants, and their spouses. PWID have regular female sexual partners, most of whom are at high risk of HIV infection because of unprotected sex with their regular (injecting) partner/husband [5, 6]. Similarly, PWID also participate in high-risk behaviors of sharing needles/syringes between injecting partners, and reusing needles kept in public places. The crossover of (illicit) drug use with sex work has also been found to be major contributing factor to the spread of HIV to other at risk populations and their partners [7, 8]. This overlap of risk behaviors puts the PWID at elevated risk of acquiring HIV and creates potential bridges for the onward transmission to other high-risk populations and their sexual partners.

Studies have revealed that behavioral and sociodemographic factors are linked to HIV infection. Lifestyle variables, socioeconomic factors, and psychosocial propensity are elements that influence HIV preventive behaviors and HIV infections [9-11].

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In Nepal, limited studies of behavioral and sociodemographic factors associated with HIV among PWID have been documented. Social and behavioral determinants affecting HIV prevalence among these groups are important and need to be assessed. With these view and importance, the present study aimed to investigate the prevalence of HIV and social and behavioral correlates of HIV infections among PWID in Nepal. This study used IBBS survey data to provide updated comprehensive assessment of the epidemic situation among the PWID, using 22 rounds of IBBS surveys.

Design and methodology

This observational study retrospectively analyzed IBBS surveys of PWID in Nepal, conducted from 2002 to 2015. IBBS surveys were cross-sectional in design and were conducted in Kathmandu Valley, Pokhara Valley, eastern Terai (3 districts), and western-to-far-western Terai (7 districts). PWID were defined as *'males current injectors aged 16 years and above who have been injecting illicit drugs for at least three months prior to the date of the survey'*. However, no data from PWID younger than 18 years old was included in the present study. IBBS surveys employed respondent-driven sampling (RDS) to recruit PWID in the Kathmandu valley and Pokhara valley. However, RDS was used in eastern Terai (3 districts) in 2002 and 2005 and in west to far western Terai (7 districts) in 2003. Two stage cluster sampling was used as the alternative to RDS in eastern and western-to-far-western Terai from 2007 onwards, because of the lack of strong network among the PWID in these regions. IBBS surveys were conducted in compliance with both ethical and human rights standards. Ethical approval for the surveys was obtained from Nepal Ethical Review Board, of Nepal Health Research Council, which approved the current study (registration number 03/2016; Ref. No. 1232). In the previous IBBS surveys, documented and witnessed informed verbal consent (to preserve anonymity) was obtained from PWID before their interview and the collection of blood samples for the IBBS. Study centers with laboratories and clinics were established at easily accessible locations in all the study districts. Individual interviews, clinical examinations, and blood collection were conducted in separate rooms in each of the study centers.

IBBS datasets for year and region were available as computer files comprising background characteristics, knowledge on HIV and AIDS, drug injecting practices, sexual behavior and access to HIV services. The independent variables selected were background characteristics (age, year, region, education, and marital status), drug injecting practices (age of first drug injection, duration of drug use and injecting drugs, used needle/syringe previously used by someone else in past week, used syringe/needle left in a public place in past week, and shared needle/syringe with someone after using in past week) and sexual behaviors (age at first intercourse, number of sexual partners, number of FSWs, consistent condom use with regular partner, FSW and nonregular female sex partner). The sex partners of the PWID were categorized as regular female sex partners, FSWs, and nonregular female sex partners. A 'regular female sex partner' is defined as spouse or any sexual partner living together with PWID. FSWs were defined as those who sell sex in exchange for cash, kind, or drugs. 'Non-regular female sex partners' were defined as those with whom the PWID was not married or living together. These may include girlfriends or other female friends with whom they have sexual relationship.

Statistical analysis

Statistical analyses were performed using the R program. Bivariate analyses were performed to estimate the association of demographic and behavioral variables with HIV prevalence using χ^2 tests. Logistic regression [12, 13] analyses were performed to determine variables associated with HIV infected proportion defined by combinations of the determinants, using the additive model:

$$\ln\left(\frac{P}{1-P}\right) = \alpha + \sum_{i=1}^{k} \beta_i x_i \qquad (1)$$

In this model, P is the expected probability of HIV infection, α is the intercept, x_i through x_k are determinants variables, β_i are regression coefficients. This model also provides confidence intervals for HIV infection for levels of each risk factor adjusted for other risk factors using sum contrast methods [14-16]. The confidence intervals based on sum contrasts has the advantage that they provide a simple criterion for classifying levels of the factor into 3 groups according to whether each corresponding confidence interval exceeds, crosses, or is below the overall percent. The confidence intervals compared percent of the specified cause group in each category with the overall percent. To compare models for prevalence

we used the area under the receiver operating characteristic (ROC) curve as measure of goodness-of-fit and a constructed mosaic plot. ROC curve sensitivity against the false positive rate to show how well the model predicts a binary outcome. For a range of decision choices, it plots sensitivity (probability of finding an outcome when it is there) against the false positive error rate (probability of finding an outcome when it is not there). It also provides a mosaic plot for comparing logistic regression models similar to an r^2 decomposition plot.

Results

Data from a total of 7,073 PWID from 2002 to 2015 were included in the analysis, of whom 17.8% (1,257) tested HIV positive. **Table 1** examines the association between background characteristics and HIV infection. Year, region, age, education, and marital status were significantly associated with HIV ($P < 0.001$). HIV infection has significantly decreased from 68% in 2002 to 6.2% in 2015. By region, Kathmandu Valley had highest prevalence (30.5%) followed by Eastern Region (18%). HIV infection was found to be associated with older age; the prevalence being 32% in those aged ≥30 years. HIV infection also varies by education; PWID who had no education (28.5%) and primary education (23.8%) had higher prevalence than secondary and above (15%). HIV infection among the married was 24%, which exceeds that of the unmarried (13.3%).

Table 1. Association between characteristics and HIV infection among people who inject (illicit) drugs

Characteristic	Total (n = 7073)	HIV infection (n = 1257, 17.7%) n (%)	Not HIV infected (n = 5816, 82.3%) n (%)	$\chi^2_{(df)}$	*P*
Year				947 (7)	<0.001
2002	303 (4.3)	206 (68)	97 (32)		
2003	645 (9.1)	187 (29)	458 (71)		
2005	1245 (17.6)	364 (29.2)	881 (70.8)		
2007	1245 (17.6)	217 (17.4)	1028 (82.6)		
2009	1245 (17.6)	129 (10.4)	1116 (89.6)		
2011	685 (9.7)	45 (6.6)	640 (93.4)		
2012	660 (9.3)	44 (6.7)	616 (93.3)		
2015	1045 (14.8)	65 (6.2)	980 (93.8)		
Region				342 (3)	<0.001
Eastern	2100 (29.7)	376 (17.9)	1724 (82.1)		
Kathmandu	1883 (26.6)	575 (30.5)	1308 (69.5)		
Pokhara	1890 (26.7)	199 (10.5)	1691 (89.5)		
Western	1200 (17)	107 (8.9)	1093 (91.1)		
Age				358 (2)	<0.001
18–20 years	1315 (18.6)	97 (7.4)	1218 (92.6)		
20–29 years	3999 (56.5)	599 (15)	3400 (85)		
30–39 years	1759 (24.9)	561 (31.9)	1198 (68.1)		
Education				82 (2)	<0.001
No education	323 (4.6)	92 (28.5)	231 (71.5)		
Primary	1483 (21)	353 (23.8)	1130 (76.2)		
Secondary and above	5267 (74.5)	812 (15.4)	4455 (84.6)		
Marital status				137 (1)	<0.001
Unmarried	4158 (58.8)	553 (13.3)	3605 (86.7)		
Married	2915 (41.2)	704 (24.2)	2211 (75.8)		

Table 2 shows the prevalence of risky behaviors in this population and the results of bivariate analyses between HIV infection and drug injecting behaviors. Risky behaviors are highly prevalent in this population. Age of first drug initiation, duration of drug use, duration of injecting drugs, previously used needle/syringe in past week, syringe/needle left in a public place in past week, and sharing a needle/syringe with someone after using it in past week, were significantly associated with HIV infection ($P < 0.001$). HIV infection was higher among the PWID who had their first drug initiation when ≥30 years, followed by those aged 20–29 years. HIV infection significantly increased with duration of drug use and injecting practices. PWID whose duration of drug use exceeded 10 years had prevalence of 32%, and those who had injected drugs for more than 10 years had a prevalence of 35%. HIV infection prevalence was higher among the PWID who used unsafe sharing practices in past week, for example, PWID who used needle/syringe previously used by someone else was 31%, used syringe/needle left in a public place had 39%, and those who shared a needle/syringe with someone after using it had 30%.

Age of first sexual intercourse, number of sexual partners, number of FSWs, consistent condom use with regular partners, FSWs and nonregular female sex partners were significantly associated with HIV infection, as shown in **Table 3** ($P < 0.001$). HIV was higher among PWID who had first sexual intercourse at 20–29 years (25%) followed by those below 20 years (17%). Similarly, HIV infection was higher who have no sexual intercourse in past year (25%) and no sex with FSW in past year (20%). HIV infection was higher among PWID who had consistent condom used with regular female sex partners (23%) and had no sex with FSW (20%) and had no sex with nonregular female sex partners (22%).

Table 2. Association between drug injecting behaviors and HIV prevalence among people who inject (illicit) drugs

Characteristics	Total (n = 7073)	HIV infected (n = 1257, 17.7%)	Not HIV infected (n = 5816, 82.3%)	$\chi^2_{(df)}$	*P*
		n (%)	n (%)		
Age of drug initiation				247 (2)	<0.001
<20 years	3870 (54.7)	571 (14.8)	3299 (85.2)		
20–29 years	2610 (36.9)	442 (16.9)	2168 (83.1)		
≥30 years	593 (8.4)	244 (41.1)	349 (58.9)		
Duration of drug use				407 (3)	<0.001
<2 years	1863 (26.3)	152 (8.2)	1711 (91.8)		
2–5 years	680 (9.6)	63 (9.3)	617 (90.7)		
5–10 years	2730 (38.6)	463 (17)	2267 (83)		
>10 years	1800 (25.4)	579 (32.2)	1221 (67.8)		
Duration of injecting drugs				295 (3)	<0.001
<2 years	3929 (55.5)	475 (12.1)	3454 (87.9)		
2–5 years	593 (8.4)	93 (15.7)	500 (84.3)		
5–10 years	1829 (25.9)	428 (23.4)	1401 (76.6)		
>10 years	722 (10.2)	261 (36.1)	461 (63.9)		
Used needle/syringe previously used by someone else in past week				196 (2)	<0.001
Yes	5283 (74.7)	904 (17.1)	4379 (82.9)		
No	962 (13.6)	301 (31.3)	661 (68.7)		
Not used in past week	828 (11.7)	52 (6.3)	776 (93.7)		
Use syringe/needle left in a public place in past week				400 (2)	<0.001
Yes	5274 (74.6)	824 (15.6)	4450 (84.4)		
No	968 (13.7)	381 (39.4)	587 (60.6)		
Not used in past week	831 (11.7)	52 (6.3)	779 (93.7)		
Share needle/syringe with someone after you used it in past week				173 (2)	<0.001
Yes	5254 (74.3)	910 (17.3)	4344 (82.7)		
No	990 (14)	295 (29.8)	695 (70.2)		
Not used in past week	829 (11.7)	52 (6.3)	777 (93.7)		

Table 3. Association between sexual behaviors and HIV prevalence among people who inject (illicit) drugs

Characteristic	Total (n = 7073)	HIV infection (n = 1257, 17.7%)	Not HIV infected (n = 5816, 82.3%)	$\chi^2_{(df)}$	*P*
		n (%)	n (%)		
Age at first sexual intercourse				67 (3)	<0.001
<20 years	5740 (81.2)	968 (16.9)	4772 (83.1)		
20–29 years	1074 (15.2)	272 (25.3)	802 (74.7)		
≥30 years	15 (0.2)	2 (13.3)	13 (86.7)		
Not had sex	244 (3.4)	15 (6.1)	229 (93.9)		
Number of sexual partners				171 (2)	<0.001
One partner	2409 (34.1)	468 (19.4)	1941 (80.6)		
More than one partner	2530 (35.8)	261 (10.3)	2269 (89.7)		
Not had Sex	2134 (30.2)	528 (24.7)	1606 (75.3)		
Number of FSW				79 (2)	<0.001
One partner	652 (9.2)	84 (12.9)	568 (87.1)		
More than one	1331 (18.8)	141 (10.6)	1190 (89.4)		
Not had Sex	5090 (72)	1032 (20.3)	4058 (79.7)		
Consistent condom use with female regular partners in past year				30 (2)	<0.001
Yes	1052 (14.9)	169 (16.1)	883 (83.9)		
No	1356 (19.2)	311 (22.9)	1045 (77.1)		
Not had Sex	4665 (66)	777 (16.7)	3888 (83.3)		
Consistent condom used with FSW in past year				86 (2)	<0.001
Yes	222 (3.1)	34 (15.3)	188 (84.7)		
No	1758 (24.9)	186 (10.6)	1572 (89.4)		
Not had Sex	5093 (72)	1037 (20.4)	4056 (79.6)		
Consistent condom used with female nonregular partners in past year				172 (2)	<0.001
Yes	569 (8)	44 (7.7)	525 (92.3)		
No	1619 (22.9)	150 (9.3)	1469 (90.7)		
Not had Sex	4885 (69.1)	1063 (21.8)	3822 (78.2)		

In bivariate analysis, all determinants were found to be significantly associated with prevalence of HIV infection. Therefore, these determinants were included for multivariate logistic regression analysis. In the multivariate logistic regression, year, region, age, education, duration of drug use was significantly associated with HIV infection. However, the study found an interaction between year and region and age and education. Therefore, year and region were combined. There were 22 levels in the year-region group factor depending on year and region. Age and education were also combined. The number of levels in the age group-education factor depends on the age and education of HIV infection. For HIV, we chose 7 levels of age group-education factor with 3 education level and 3 age groups (16–20 years, 21–30 years, and >30 years). However, PWID who had no education were merged in one group because of the small sample size.

In the logistic regression, year-region factor, age group-education factor, and duration of injecting drugs were significantly associated with HIV infection. The graph below shows results from fitting logistic model for HIV infection prevalence, with year-region factor, age group-education factor, and duration of injecting drugs as determinants. The model also highlights a substantial decrease on HIV infection prevalence from 2002 to 2015. Kathmandu Region had highest prevalence compared to other regions of Nepal. HIV infection prevalence increases with age. The prevalence was highest for those aged ≥30 years. Education was significantly associated with HIV infection as the highest prevalence was observed among the illiterate in all age groups. Moreover, the prevalence significantly increased with duration of injecting drugs. Higher prevalence was found among PWID who had a duration of injecting drugs >10 years.

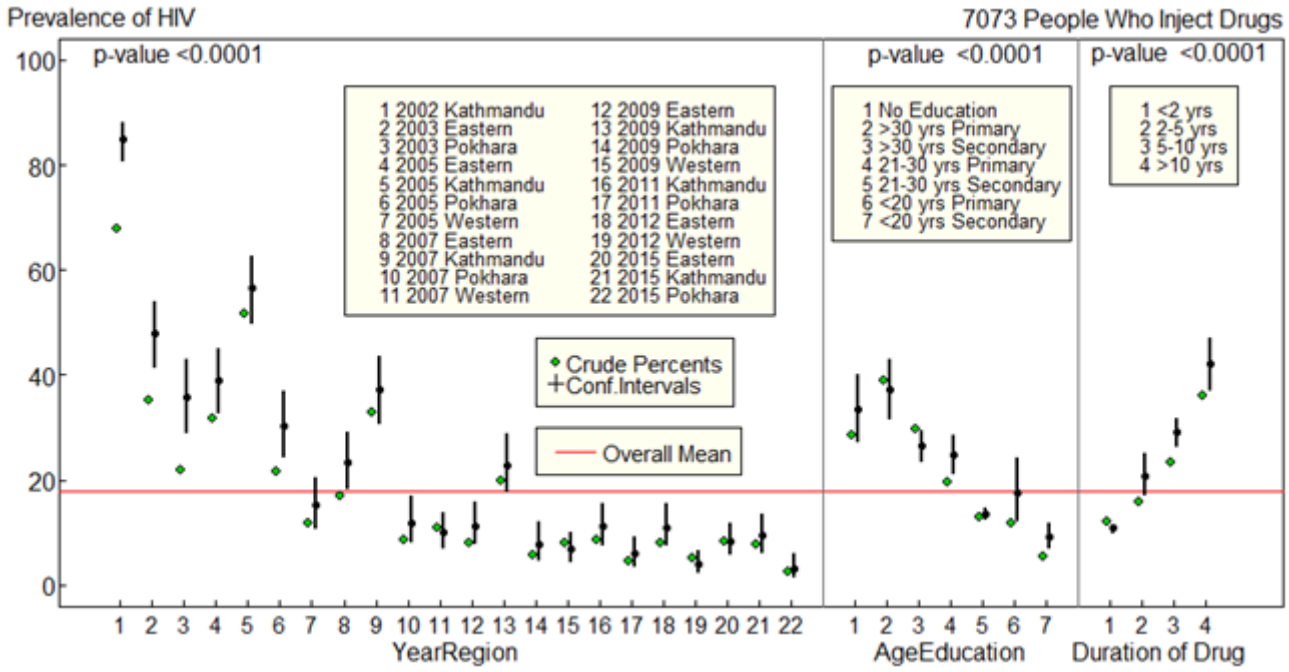

Figure 1. Factors associated with HIV infection prevalence in multivariate logistic regression

Receiver operating characteristic (ROC) curve

Figure 2 shows a ROC curve for final model fitted to HIV infection prevalence. ROC curves provide a mosaic plot for comparing logistic regression models. The area under the curve (AUC) as 0.70, indicating model performance is fit. ROC curves show that model containing year-region factor, age-education factor and duration of injecting drug fits the prevalence data extremely well.

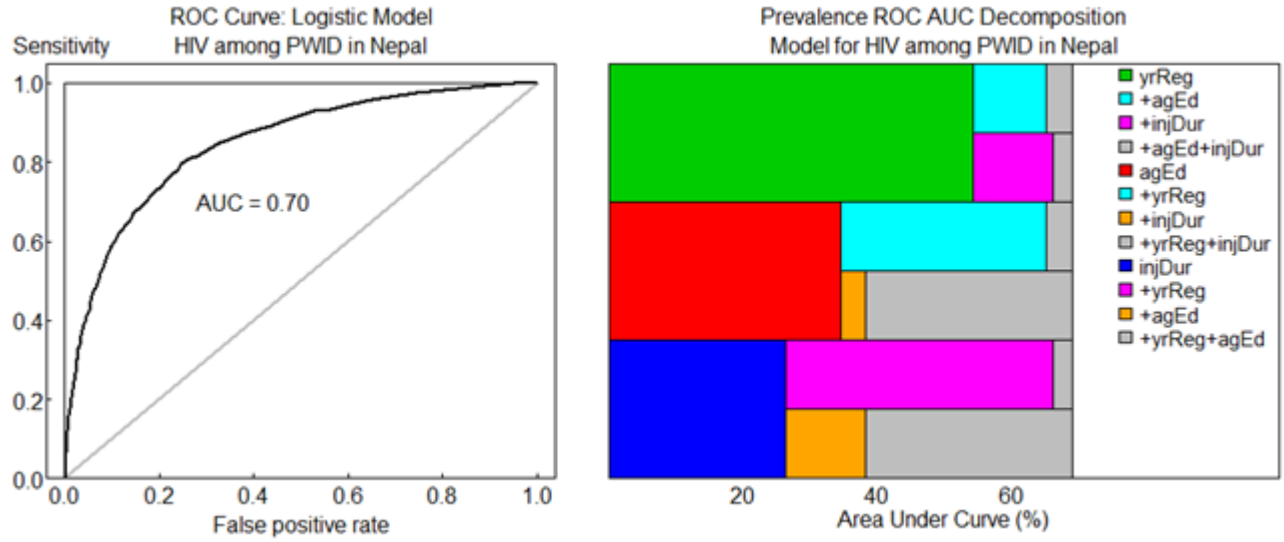

Figure 2. ROC curve: logistic model for HIV infection among People Who Inject Drugs in Nepal. Key: yrReg is year-region factor, agEd is age-education factor, and injDur is duration of injected drug use

Discussion

IBBS surveys were analyzed to confirm that PWID in Nepal are indeed at elevated risk of HIV infection. The study found year-region factor, age group-education factor, and duration of injecting drugs were associated with HIV prevalence in a multivariate logistic regression. This study showed notable success in the prevention of HIV infection among PWID. HIV infection prevalence among PWID has significantly decreased from 2002 to 2015. Factors such as access to HIV infection intervention programs, needle sharing programs, safe drug injecting practices, safe sexual practices with partners, and increase knowledge of HIV had contributed to decrease in HIV infection prevalence in recent years. Data from the IBBS surveys and Nepal Demographic Health Survey (NDHS) surveys delineate major improvements in several factors that may have attributed to this decline in HIV infection among these groups [4-8, 12]. Moreover, the prevalence remains similar in the latest three IBBS surveys of 2011, 2012, and 2015. Although, HIV infection prevalence in Nepal remains stagnant in recent years, PWID still remain the most vulnerable subpopulation compared to other KAPs with regard to HIV infections [4-8].

There was pronounced spatial variation of HIV infection in four zones of Nepal. High HIV prevalence was found in Kathmandu and the Eastern region compared with Western Region and Pokhara. The highest concentration of drug user population is confined in the Kathmandu Valley and in the locations along the Eastern Highway. According to mapping and size estimation among drugs users, around 4,341 to 4,758 drug users were living in Kathmandu [17, 18]. In Kathmandu, PWID has been widespread in the shooting galleries that are typical common places for PWID to congregate, and these are found in clandestine locations that often provide opportunities for buying, renting, or borrowing needles/syringes and other items for injection. Higher prevalence in the Eastern Region may also be a consequence of cross-border issues with India. The open and porous border between these two neighbors has provided an ideal passage for smugglers for decades, and districts mostly in the Terai region of the country turned into a major transit points for peddling drugs.

HIV infection prevalence was positively associated with increasing age and low education status. A previous study has shown that not only are young PWID at increased risk of HIV, but also that those who use drugs in shooting galleries, or places with other and older PWID, are more likely to start injecting drugs early, and are at increased risk of HIV, partly because of the high prevalence among the older subgroup [19]. HIV infection was also associated with low education level. A study in Nepal among female drug users also shows similar results, i.e., low education is strongly associated with HIV infection prevalence [9]. Low or limited education relates to poor awareness about HIV or acquired immuno-deficiency syndrome (AIDS), and contributes to their vulnerability. In Nepal, PWID often came from rural areas and have limited education, making them extremely vulnerable to drug involvement and unsafe sex. Their powerlessness and poor understanding of their own risk probably also make them more likely to engage in high-risk drug use and unsafe sexual practices [4, 8].

Consistent with previous studies, injection behavior showed a strong association with HIV infections in this population [9-11]. HIV infection prevalence was higher among PWID who had a long duration of injecting drugs (>10 years). This association could be causal because the sharing of injection needles over long duration was associated strongly with HIV infection rates, and in a dose-dependent manner. Sharing needles or syringes and other equipment for injection is the most frequent drug-related risk behavior, which puts the PWID at risk of HIV transmission. In Nepal, the sharing practice is deeply rooted within the PWID social and cultural context. In addition, other frequently cited reasons for sharing include limited resources; lack of clean needles/syringes, and fears of arrest by law personnel, all of which reinforce reusing and sharing equipment [5, 8].

PWID provide an effective epidemiological bridge for a wider epidemic, through unsafe sexual practices with their regular partners (wives) and with nonregular partners. Unprotected sex behavior also increased HIV risk among the PWID. The risk was significantly increased by sex with commercial or casual sex partners. In the present study, we found the number of sexual partners and the inconsistent use of condom with a regular partner were significantly associated with HIV infection in bivariate analysis. However, in multivariate analysis, no statistical association was found. HIV infection was higher among PWID who do not have sex or had one sexual partner in past year. This may be the result of PWID were aware of their status and limited their sexual intercourse with partners.

Moreover, PWID perceive that the risk of HIV transmission is less likely through sexual contact than through sharing injection items, and were therefore less likely to adopt safe sex than safe injection practices. Similarly, HIV infection was higher among those consistently using a condom with their regular female sexual partners. The reason may be the PWID were using condoms to either prevent HIV transmission to their clients, or as self-protection from infection with HIV, or sexually transmitted diseases. In addition, previous studies among drug users have found safer sex practices strongly associated with HIV infection. A study in the United States found that self-reporting as HIV infected was the strongest factor associated with consistent condom use in the past 6 months [20]. Another study in Puerto Rico found that HIV-positive drug users were nearly five times more likely to use condoms during vaginal sex [21].

Consistent with earlier findings [22-24], the HIV risk behaviors include sharing injecting equipment and unprotected sex, and the risk of contamination from sharing practices and nonsanitized usage of injecting equipment is present in considerable proportions, albeit in varying degrees. Programs to target HIV infection prevention and treatment should be urgently developed and implemented for this population. Provision of clean needles and syringes will be useful for the prevention of HIV transmission through networks of PWID.

In conclusion, the decrease in HIV infection prevalence among the PWID gives the impression that HIV infection prevention interventions have been successful in Nepal. Data from the upcoming IBBS survey rounds are expected to provide more specific insights into the level of impact by interventions in the study sites. This study also guides policymakers on designing HIV and sexually transmitted infection intervention programs based on the risk factors.

The study has a few limitations. IBBS surveys are cross-sectional by their design and cannot provide evidence of causal relationships between the determinants and HIV infections. Moreover, this study covered only HIV infection and risk-related behaviors, while other issues related to HIV intervention programs and drug policies have not been discussed. Despite such limitations, the positive association between background characteristics and drug injecting practices that increase the risk of HIV infection have important implications.

Authors' contributions

All authors have made a substantial contribution to the concept and design, acquisition of data or analysis and interpretation of data, drafted the article or revised it critically for important intellectual content, and approved and take responsibility for the version to be published, the final manuscript.

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Conflict of interest statement

The authors declare that there is no conflict of interest in this research.

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