

Trends and determinants of HIV transmission among men who inject drugs in the Pokhara Valley, Nepal: Analysis of cross-sectional studies

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Abstract

Background HIV is a major public health issue around the world, especially in developing countries. Although the overall prevalence of HIV in Nepal is relatively low and the country itself is considered low risk, there are specific sub-populations where the prevalence is far higher than the national average. One of these sub-groups is male injection drug users (IDUs). In order to understand the reasons for the differences in prevalence, a series of socio-demographic, behavioural and knowledge-based risk factors need to be assessed.

Methods The study used a series of 7 cross-sectional survey datasets, collected between 2003 and 2017 (N=2,235) to investigate trends in HIV prevalence among male IDUs by key socio-demographic and behavioural and knowledge-based risk factors. A series of logistic regression models were conducted to investigate the association between study factors and HIV in the Pokhara valley, Nepal.

Results Overall HIV prevalence has decreased from the levels seen in 2003 (22.0%) and 2005 (21.7%), with the lowest prevalence recorded in 2015 (2.6%), however prevalence has increased in the most recent period (4.9%). A lower risk of HIV was associated with younger age (less than or equal to 24 years compared to greater than 24 years, OR = 0.17, 95% CI = 0.10, 0.31), not being married (OR = 0.51, 95% CI = 0.33, 0.80) and shorter duration of drug use (less than or equal to 4 years compared to greater than 4 years, OR = 0.16, 95% CI = 0.09, 0.29). A higher risk of HIV was associated with low (compared to secondary or higher) education level (OR = 2.76, 95% CI = 1.75, 4.36), a lack of addiction treatment (OR = 2.59, 95% CI = 1.64, 4.08), and recent use of unsterilized injection equipment (OR = 2.22, 95% CI = 1.20, 4.11).

Conclusion Although knowledge of HIV is high among male IDUs, the prevalence of individuals who possess comprehensive knowledge and the number of individuals who have received treatment for drug addiction has decreased. This may indicate that addiction treatment and HIV education programs need to be strengthened.

Background

The spread of human immunodeficiency virus (HIV) among at-risk populations is an important health issue around the world (1). Several factors have been shown to increased HIV transmission in many communities worldwide. These include safe sex practices, needle sharing habits, intravenous drug use, poor equipment cleaning practices and alcohol consumption (2-4). Stigma, discrimination and misinformation also play important roles in HIV transmission as they prevent correct dissemination of appropriate information and implementation of preventive methods (5, 6).

In Nepal, there are many at-risk groups in some specific locations (the Pokhara Valley and Kathmandu), with a high number of drivers of disease transmission like increased economic activities (7-16). These at-risk groups include people who inject drugs, female sex workers, men who have sex with men and labour migrants (17). These groups are at particularly high risk of contracting HIV and other blood borne

diseases such as hepatitis B infection (18). Without routine testing being readily available and accessible or community-based education on the risks of HIV transmission, there is an increased likelihood of HIV disease burden throughout the community (13).

Previous studies from Nepal have determined the incidence and prevalence of HIV among the at-risk groups to provide relevant data for targeted interventions (8, 11, 12, 14). However, those studies focussed on specific geographical areas and ignored others where there are higher levels of drivers and determinants of HIV transmission, such as the Pokhara Valley (17). While Nepal is considered to be a low prevalence population (19), monitoring and evaluating the HIV epidemiology in specific high-risk locations is still an important public health priority (17). Public health surveillance programs for HIV has also been recognised as an issue in Nepal (19).

In a recent paper, it was determined that condom adherence is more strongly associated with socio-demographic features than education level or knowledge of HIV (20). This could indicate that sexual health education programs are not currently working as effectively as necessary. Caste and ethnicity also act as major determinants of overall health literacy and knowledge of preventative measures (21). Injecting drugs at any point within a year has been shown to be a risk factor for non-utilisation of HIV testing centres (22), meaning that the study population are less likely to access these HIV preventative measures than other at-risk groups.

There has been previous descriptive research in the Kathmandu Valley in Nepal into key risk factors and prevalence trends (7-9, 17), however, more detailed analytic approaches to investigate socio-demographic and behavioural factors are currently lacking for this setting. Previous behavioural studies have also shown that there are multiple risk factors that act as determinants for HIV and other sexually transmitted diseases within other areas of Nepal (10, 11), such as social class and education level (21). Accordingly, this study aimed to investigate trends and the associations between socio-demographic, behavioural and knowledge-based factors and HIV transmission among male intravenous drug users (IDUs) in the Pokhara valley, Nepal from 2003 to 2017. This would provide a more detailed perspective of HIV information among this cohort to inform policy and prevention strategies.

Methods

The Integrated Biological Behavioural Surveys (IBBS) are a series of surveys taken once every two years in Nepal, beginning in 2003. There have been 7 iterations of this survey. The surveys are intended to track the prevalence of various diseases among targeted populations. In addition to assessing disease prevalence, the surveys recorded demographic, behavioural and social factors as part of the surveillance of HIV in Nepal (17). The key populations that the IBBS focus on are people who inject drugs (PWIDs), labour migrants, sex workers spouses and men who have sex with men (17).

Study sample:

This study uses a series of behavioural surveys taken between 2003-2011 and 2015-2017. The total number of participants across this period was 2,235 men over the age of 16 who had been injecting drugs for a period of at least three months. Participants were recruited using respondent driven sampling methods, where seeds from the specific target population of male IDUs were selected. A full description of the selection and sampling methods are available in the IBBS (17). The 2003, 2005, 2007 and 2009 surveys all had 300 participants, while the 2011, 2015 and 2017 surveys each had 345.

Face-to-face interviews were performed with participants' answers being recorded on a set questionnaire, with the 2017 survey being performed on tablets. The IBBS surveys recorded a wide array of variables, a selection of which were used in the present study (a full list of which is available at the end of each IBBS survey). HIV testing was performed using the Determine HIV 1/2 test (manufactured by Abbot, Japan), which detects the presence of antibodies against HIV. If this first test produced a positive result, a second and third test were used for confirmation. These tests were Uni-Gold (Trinity Biotech, Ireland) and Stat-Pak HIV 1/2 (Chembio Diagnostics). If the first test was negative, then no further testing was done. The full testing algorithm is available in the IBBS reports (17), and also shown in Figure 1.

Outcome:

The main outcome of interest in this study was HIV infection. This was defined by use of two rapid detection kits and collected from participants by testing blood samples. The tests were used in a cascading series, where if the first test returned a positive result, the second test would be used to confirm or contradict this result (17). Cases were determined to be HIV positive only if all three tests showed the blood sample to be reactive. The testing cascade differed in the earlier surveys (2003-2011) so that positives were counted either if the first and second tests were both positive. This difference was due to the different testing kits used from 2003-11.

Study factors:

Socio-demographic factors included age, education, and marital status, which were all defined as binary variables to maximise the size of comparator groups given the small sample size available at each time-period. Age was defined as being either "above" or "below" the median age. Similarly, education status was defined as being "primary or lower school education" and "secondary or higher school education", while marital status was categorised as a "married" or "not married". Living situation, which was defined as living "with" or "without" a sexual partner was also included in socio-demographic factors.

Behavioural factors included having undergone treatment for drug addiction, being tested for HIV, visiting an HIV testing and counselling centre, duration of intravenous drug use, use of a female sex worker, needle sharing behaviours, alcohol intake, condom use, use of unsterilized injecting equipment and the age at which drugs were first injected. Most of these factors were binary "yes" or "no" variables. Duration of drug use and age at first injection were defined as being "above" or "below" the median, while alcohol intake was broken into "everyday", "sometimes" and "never".

Participant characteristics

Overall, the average age of male IDUs interviewed between 2003 and 2017 increased. The lowest average age occurred in the 2003 survey (average age of 23.4 years), and generally increased with each iteration of the survey. Average age decreased slightly between 2007 and 2009 (24.8 to 24.5 years), before increasing in 2011 (24.9 years). The highest average age occurred in the 2017 (28.2 years).

The education status of the respondents increased every year between 2003 and 2015, before decreasing in 2017. The highest completed grade of school on average in the surveys occurred in 2011 and 2015 (Grade 9). The average highest completed grade in 2003 was Grade 7, before increasing to Grade 8 in all other years.

Factors relating to knowledge of HIV included knowing someone with HIV/AIDS, having met and discussed HIV with a peer/community educator (PE/CE), and knowledge of where to access antiretroviral therapy.

A summary of participant characteristics is provided in Supplementary Table 1.

Analysis

Prevalence estimates and 95% confidence intervals for HIV were examined over the period spanning 2007-2017, stratified by each of the study variables described above.

A separate series of logistic regression models that were restricted to the period 2007 to 2017 were also conducted. Models were restricted to this period because the prevalence numbers expressed in 2003 and 2005 were likely substantially affected by measurement bias. This was due to overestimation of the positive results, which may have been due to a change in the HIV testing regime and the definition of a positive case. Univariable and multivariable logistic regression models were conducted to investigate the association between the socio-demographic, behavioural and knowledge factors described above and HIV status. Models were aggregated over the period 2007-2017. Additionally, single years were investigated to examine how the magnitude of relative associations changed over the period. Multivariable models adjusted for the potential confounding factors of age, education level and marital status. All analyses were conducted in R Studio using the `glm` and `confint.lm` functions.

Results

HIV prevalence decreased over the study period 2003 to 2015 from 22% to 2.6% before rising again in 2017 to 4.9% (Table 1). The lowest prevalence for HIV in the study populations occurred in 2015 (2.6%, 95% CI 1.2-4.9%), however prevalence has increased in the most recent period in 2017 numbers (4.9%, 95% CI 2.9-7.8%). There was a decrease in every survey prior to 2017, with the largest decrease occurring between 2005 (21%, 95% CI 17.1-26.8%) and 2007 (8.6%, 95% CI 5.7-12.4%). HIV prevalence was higher among participants who were above the median age in all years, and was also lower in participants who had achieved secondary education or higher in all years except for 2003 (Table 1.) Having injected with a

used syringe in the previous week had a higher prevalence of HIV in all years except for 2015 (Table 2). HIV prevalence was higher among participants who had received treatment for drug addiction in all years (Table 3). Individuals who knew others with HIV/AIDS and knew where to receive ART also had a higher prevalence of HIV (Table 3.).

Lower risk of HIV was associated with an education level of secondary school or higher (OR = 0.36, 95% CI = 0.23, 0.57), marital status (OR = 0.51, 95% CI = 0.33, 0.80), having never received addiction treatment (OR = 0.39, 95% CI = 0.25, 0.61), not having discussed with PE/CE (OR = 0.55, 95% CI = 0.32, 0.96) and not having knowledge of ART (OR = 0.21, 95% CI = 0.13, 0.33) (Tables 4 and 5). In addition to this, not having had sex with a FSW in the past year was also protective, however had a statistically insignificant confidence interval.

A higher risk of HIV was associated with being above the median age of 24 (OR = 5.75, 95% CI = 3.19, 10.36) and having injected drugs for more than the median duration of 4 years (OR = 6.94, 95% CI = 3.91, 12.31) (Table 5.). Not using a condom with an FSW and first injecting later than the median age of 20 years old were also associated with higher risk of HIV prevalence, although differences were not statistically significant (Table 5.).

Discussion

The findings in this study indicate that the main behavioural determinants of HIV among male IDUs in the Pokhara valley are use of unsterilized needles, a lower level of education and high alcohol intake. Low alcohol use and not having sexual intercourse with female sex workers in the last year were both associated with a lower risk of HIV, although the association was statistically insignificant. It was found that having an education level of secondary school or higher, not being married, having never received addiction treatment, not having discussed with PE/CE and not having knowledge of ART were all associated with lower risk of HIV.

Findings also indicate that the number of IDUs who had ever received treatment for their addiction has decreased since 2007. However, daily alcohol consumption and use of female sex workers decreased over the study period, which occurred contemporaneously with the decline in HIV prevalence from 2007 onwards. In the most recent survey, the decrease in alcohol consumption is potentially due to changes in government regulations on alcohol (23). Analysis of the prevalence of different behaviours indicated that frequency of the majority of needle sharing behaviours also decreased. Education status was not consistently significant in either the unadjusted or adjusted models, although individual years produced statistically significant ORs. One study based on drug use in third-year medical students in Kathmandu noted that most respondents reported that they only began using drugs after admission to medical school (24). This potentially indicates that drug use is closely associated with education levels.

Younger age was found to be associated with a lower risk of HIV in all models, which is consistent with previous findings (25, 26). There are slight differences in the magnitude of the observed association, however this may have been due to the differences in classification when creating a dichotomous age

category. Similarly, being married was associated with low risk of HIV in several of the models from this study, but not in the 2003 IBBS survey.

Recent use of unsterilized injection equipment was predictably a risk factor for HIV status in the 2007-2017 models, although was not consistently statistically significant. This may be due to a variety of factors, such as difference in cleaning methods or the effect of the demographic confounders being adjusted for. Unsterilized or contaminated equipment has been shown to be a risk factor in multiple different settings (4, 8, 27, 28). This problem is likely to be exacerbated by the low coverage of programs aimed at providing PWIDs with clean injecting equipment. Data from 2016 shows that the current rate of distribution of clean needles is far lower than the recommended standard of at least 200 per PWID per year (29).

In general, HIV knowledge was high among the participants of the surveys. Most of the participants knew someone with HIV/AIDS, and most had what was determined by the DHS standards as a “comprehensive knowledge of HIV”. The number of individuals with comprehensive knowledge increased from 2015 to 2017, suggesting better engagement in HIV education services in male IDUs. However, the high risk associated with never having experience addiction treatment and not using PE suggests that although the knowledge of HIV was relatively high, health programs were being accessed insufficiently. It should also be noted that coverage of these healthcare programs in Nepal is limited, which may be the reason for lower rates of accessing these programs.

Conversely, knowledge of where to receive anti-retroviral therapy reached the lowest number in 2017. Compared to other developing countries, the level of knowledge of HIV in Nepal is encouraging. Data gathered from the DHS (Demographic and Health Surveys) and AIDS Indicator Surveys (AIS) in 33 sub-Saharan countries showed only minimal increases in the level and spread of HIV knowledge between 2003 and 2015 (30).

There are several potential limitations with this study. Most of these relate to the cross-sectional nature of the data, conducted at multiple time points which opens up the potential for small shifts in methodology to affect consistency in measurement over time. In addition to this, some of the data from the 2017 set was missing (including data on knowing someone with HIV), meaning that some risk factors were unable to be properly investigated in this year.

It is also difficult to determine the role of changes in legislation or other HIV specific interventions across the timespan of the IBBS surveys. The difficulties in utilising the findings from IBBS surveys has been noted in the past, with several reasons provided for why the interpretation and implementation of findings is complicated (31). The difficulties mentioned are also likely to impact the results of the surveys, such as issues with sampling consistency. Some sources of measurement bias are likely to be present in the surveys, as they were conducted by different people across a relatively large time. Additionally, the survey results relied heavily upon the self-reporting of the participants, potentially creating inaccuracies. Selection bias is also possible, as volunteerism means that the IDUs selected for the survey may not have been representative of all IDUs in Pokhara.

Due to the cross-sectional study design, temporality and causality are also difficult to establish. Although the answers for variables may indicate causality, it cannot be ascertained which of the variables came first.

However, there are strengths to the study. For example, analysing the changing risk of different behaviours over time is helpful in determining if health programs are acting effectively in reducing HIV prevalence. HIV diagnoses were not reliant on self-reporting, but were based on biological samples, reducing the likelihood of reporting bias. In addition to this, knowing which behavioural and demographic risk factors are becoming more prevalent in recent years is valuable information for health service programs. Targeted HIV prevention programs have provided encouraging results, both in Nepal (32) and other developing countries (33-35). Strengthening and tailoring the current HIV programs to better suit the individuals who need them should be a priority moving forward.

Increasing both the knowledge of and access to anti-retroviral therapy is also a potential avenue of reducing the spread of HIV, as it has been shown that ART is one of the most effective mechanisms of controlling HIV (36). The issues with ART adherence and access in Nepal have been noted previously (37). In the most recent government strategy document related to HIV control, the National HIV Strategy 2016-2021 (29) targets 90% retention for individuals diagnosed with HIV on ART, while also aiming to identify, test and correctly diagnose 90% of the key populations (29). The results found in this paper appear to show that the numbers of IDUs who have been tested for HIV, while increasing, remain below the 90% target testing rate. Additionally, the numbers of HIV positive individuals in this study who know where and how to get ART were far lower than the target, as only 16% of those with HIV and only 12% of IDUs overall knew where to receive this treatment.

Conclusion

This study has identified several important socio-demographic and modifiable behavioural risk factors associated with trends in HIV prevalence among male IDUs in Nepal to inform current population health policy strategies and responses. Based on the levels of knowledge of the male IDUs, addiction treatment and HIV education programs need to be strengthened in future intervention strategies.

List Of Abbreviations

AIDS – Acquired Immune Deficiency Syndrome

AIS - AIDS Indicator Surveys

ART – Antiretroviral Therapy

DHS - Demographic and Health Surveys

FSW – Female Sex Worker

HIV – Human Immunodeficiency Virus

IDU – Intravenous Drug User

IBBS – Integrated Biological Behavioural Survey

PE/CE – Peer Educator/Community Educator

PE/OE/CM/CE - Peer Educators/Outreach Educators/Community Motivators/ Community Educators

PWID – People Who Inject Drugs

Declarations

Ethics Approval and Consent to Participate

The original ethics approval granted to the IBBS projects in Nepal was given by the Nepal Health Research Council (NHRC). The survey was conducted in compliance with all human rights and ethical standards required by health researchers conducting studies on human subjects.

Written informed consent was obtained from individuals before the interview process in the survey, in the presence of a witness who then signed the consent form. The surveys did not record personal identifiers, with an aim to maintain privacy and anonymity. Participants were provided with opportunities to ask questions during the screening process to help aid their decision to participate or decline to participate. Additionally, potential participants were made aware that they were able to freely decline involvement during any stage of the survey. Risk to individuals was minimal, and best efforts to maintain the minimal risk. During analysis and presentation of the survey findings, names and addresses of participants were not mentioned.

Consent for Publication

Not applicable

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors have no competing interests to declare.

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SD received a grant paid to CMDN by the Global Fund via the Nepal Government, which covered the costs of the IBBS surveys. This funding is no longer current. No other authors received funding for this project.

Authors' Contributions

SH was a major contributor in writing the manuscript and analysing the data sets. AP and SM contributed to writing the manuscript and advised on statistical analysis. FO contributed to writing the manuscript. RR contributed to data acquisition and statistical analysis. BR and KD were major contributors on the design and publication of results from the original IBBS projects. All authors have read and approved the final manuscript.

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Tables

Due to technical limitations the Tables are available as a download in the Supplementary Files.

Figures

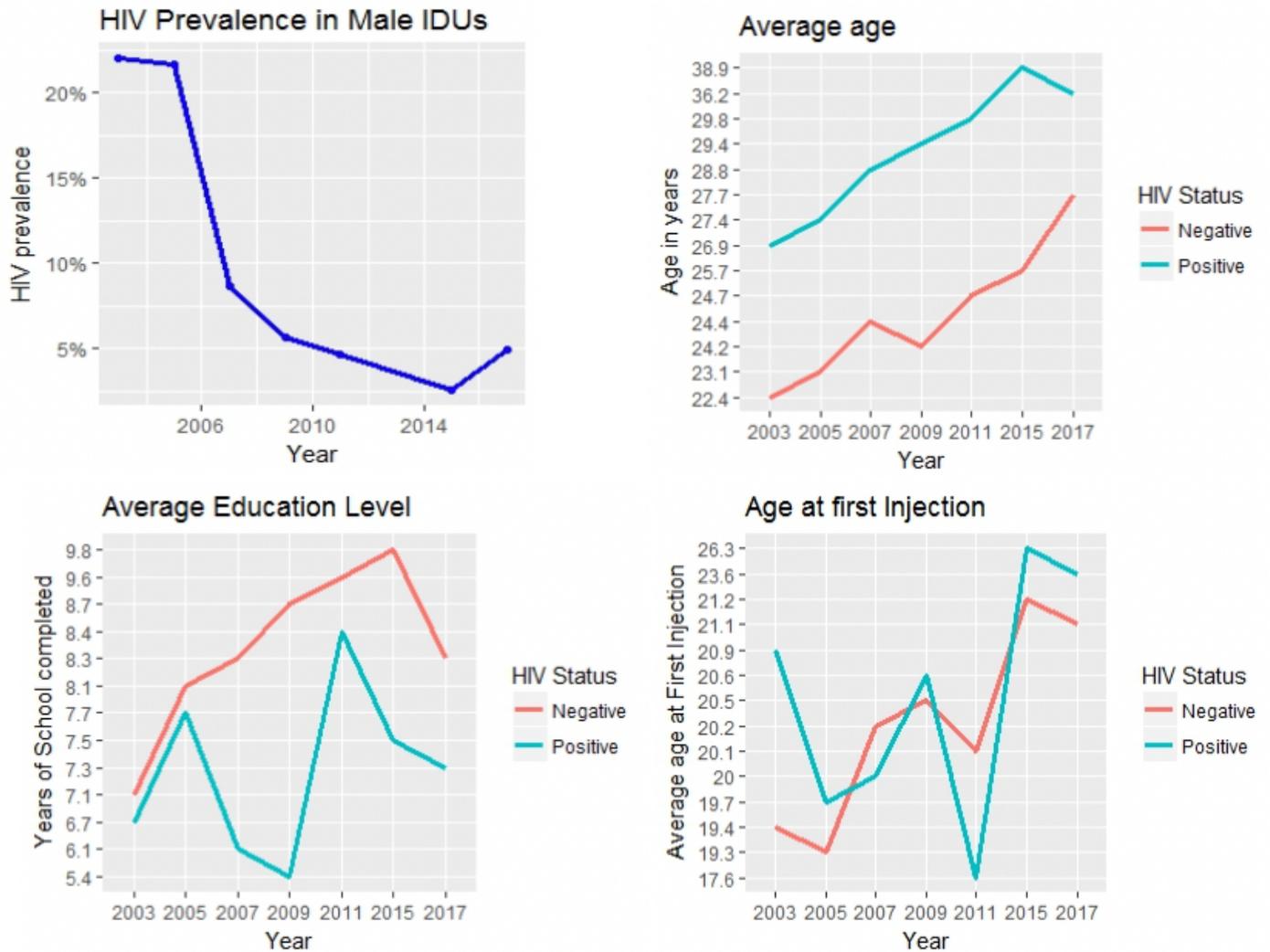


Figure 1

(A) HIV Prevalence over Time, (B) Average age, (C) Average

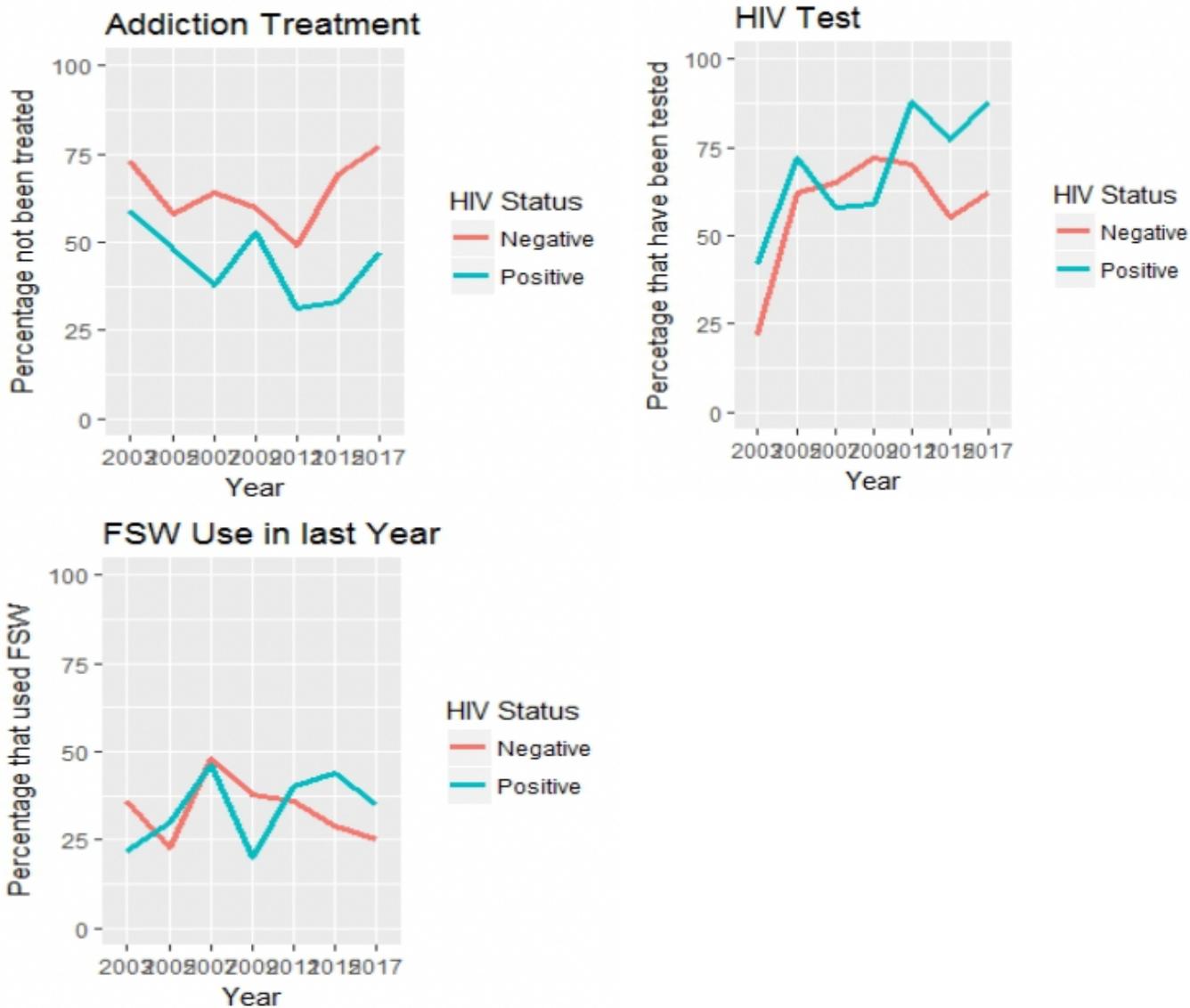


Figure 2

(A) Addiction Treatment prevalence, (B) HIV Testing prevalence and (C) Female Sex Worker Use in the last Year

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table.pdf](#)
- [SupplementaryTable1.pdf](#)