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# ASSOCIATION BETWEEN NEEDLE SHARING BEHAVIOR AND HIV/HCV COINFECTION INCIDENTS IN INJECTING DRUG USERS

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## ABSTRACT

The 2018-2019 Integrated Biological and Behavioral Survey (IBBS) reported that Human Immunodeficiency Virus/Hepatitis C Virus (HIV/HCV) coinfection was most prevalent among Injecting Drug Users (IDUs), reaching 69.7%. Needle sharing behavior among IDUs can increase the risk of exposure to bloodborne infection such as HIV and HCV. This study aimed to examine the association between needle sharing behavior and HIV/HCV coinfection among IDUs in West Java Province, using data from 2018-2019 IBBS and a cross-sectional study design. Respondent-Driven Sampling technique was employed in the 2018-2019 IBBS, yielding 1,478 samples. Data analysis was conducted up to the multivariate stage using Cox regression. The prevalence of HIV/HCV coinfection among IDUs in West Java was found to be 6.8%. Needle sharing behavior was not significantly associated with HIV/HCV coinfection among IDUs (APR: 0.77; 95% CI: 0.41–1.45; p-value = 0.424), with confounding variables being gender, history of incarceration, and duration of injecting drug use, where the most significant variable was a history of incarceration (APR: 3.29; 95% CI: 2.19–4.93; p-value < 0.001). Health interventions should prioritize IDUs with a history of incarceration. Strengthening health services and harm reduction programs in correctional facilities, providing education on HIV/HCV prevention, and developing reintegration programs for formerly incarcerated IDUs are necessary.

**Keywords:** coinfection, hepatitis C, human immunodeficiency virus, injecting drug users, needle sharing

## Introduction

Hepatitis C virus (HCV) and human immunodeficiency virus (HIV) are two chronic viral infections that affect millions of people worldwide, and in the absence of effective vaccines for either virus, their coinfection has emerged as a growing and serious public health concern. Hepatitis viruses are a major and increasing cause of mortality among people living with HIV, particularly HCV. Individuals with HIV are at higher risk of contracting HCV due to shared transmission routes between HIV and HCV, including needles sharing during intravenous drug use, sexual contact, and mother-to-child transmission during the perinatal period.[1,2] The occurrence of HIV and HCV infections is referred to as HIV/HCV coinfection. WHO estimates that approximately 2.3 million (6.2%) of the 37.7 million people living with HIV have serological evidence of past or current HCV infection.[3] A study in Singapore found a prevalence of HIV/HCV coinfection at 6%.[4] In contrast, data from the 2020-2024 National Action Plan for Hepatitis Control by the Indonesian Ministry of Health revealed that the prevalence of HIV/HCV coinfection in Indonesia between 2017 and 2019 exceeded WHO's estimate and Singapore's prevalence, ranging from 16.4% to 33.6%.[5] In individuals with HIV/HCV coinfection, HIV can accelerate the progression of chronic HCV. HCV infection may also affect HIV treatment.[6] WHO hightlights chronic liver disease as leading cause of morbidity and mortality among people living with HIV. Those with HIV/HCV coinfection tend to have higher HCV viral loads, which can speed up liver disease progression and increase the risk of developing liver cirrhosis. However, it remains unclear whether HCV similarly accelerates the progression of HIV infection.[7–9]

HCV coinfection is common among intravenous drug users (IDUs) living with HIV.[6] The 2018-2019 Integrated Biological and Behavioral Survey (IBBS) conducted by the Indonesian Ministry of Health found that HIV/HCV coinfection among IDUs reached 69.7%, significantly higher than other key populations.[10] Several risk factors may contribute to HIV/HCV coinfection among IDUs, one of which is needle-sharing behavior. The 2018-2019 IBBS further revealed that 41% of IDUs shared needles in the month prior to the survey. This indicates that needle-sharing is a common practice among IDUs.[11] The Centers for Disease Control and Prevention (CDC) states that individuals are at high risk of contracting or transmitting HIV and other infections through needle-sharing or the use of other drug-injecting equipment.[12] This occurs due to the sharing of needles or other injecting tools, which heightens the likelihood of exposure to blood from individuals infected with HIV or HCV[7] Numerous studies have corroborated the association between needle-sharing and an increased risk of HIV/HCV coinfection among IDUs.[13–16]

Understanding the risk factors for HIV/HCV coinfection among IDUs is essential for formulating effective evidence-based strategies to reduce its incidence in Indonesia. Research on intravenous drug use and HIV/HCV coinfection in Indonesia remains limited. A study on this topic was conducted at Tebet Regional Hospital in 2020. In 2023, another study used the 2018-2019

IBBS data to examine factors associated with HIV/HCV coinfection among IDUs in seven districts/cities in West Java. Nevertheless, these studies did not focus on analyzing the causal relationship between IDU behavior and HIV/HCV coinfection in this population. Therefore, the specific contribution of syringe-sharing practices to the prevalence of HIV/HCV coinfection among injection drug users in West Java has not been adequately established in existing analyses of the 2018–2019 IBBS data. In addition, a study conducted in 2023 using the 2018–2019 STBP data employed statistical analysis only up to the bivariate stage. As a result, the most dominant factors associated with HIV/HCV coinfection could not be accurately identified, and no control for potential confounding variables was applied.[17,18] The limited research on the causal relationship between needle-sharing behavior among IDUs and HIV/HCV coinfection in Indonesia, along with the fact that a previous study employed only bivariate analysis without controlling for potential confounding variables, prompted the researchers to conduct this study. Therefore, this study aims to analyze the relationship between needle-sharing behavior and HIV/HCV coinfection among IDUs in West Java Province using data from the 2018-2019 Integrated Biological and Behavioral Survey (IBBS).

## Methods

This research was conducted from October to December 2024 using a quantitative approach with a cross-sectional study design, utilizing data from the 2018-2019 Integrated Biological and Behavioral Survey (IBBS) in West Java Province, Indonesia. The data were obtained from the Directorate of P2PM, Ministry of Health of the Republic of Indonesia. The sampling technique used in the 2018-2019 IBBS was Respondent-Driven Sampling (RDS), a form of snowball sampling method.

In this study, the sample consisted of all IDU respondents from the 2018-2019 IBBS. The minimum sample size needed for this study was calculated using the Lemeshow's hypothesis tests for the two population proportion equation with with P1 and P2 values based on previous research with a 95% confidence level, yielding a minimum sample size of 52 respondents. Subsequently, the researcher doubled this calculated sample size to accommodate two samples and added 10% of the calculated sample size to account for potential missing data. The inclusion criteria were men or women who are 15 years old or older who use drugs by injection for non-medical purposes at least once in the last year and have lived in the survey city for at least one month with reactive or non-reactive test results for both infections (HIV and Hepatitis C). The exclusion criterion was IDUs with test results for only one infection. Respondents with incomplete data on HIV/HCV coinfection or needle-sharing behavior variables were excluded from the analysis. After data cleaning based on the exclusion criteria and missing data in the variables for coinfection status and needle-sharing

behavior, the final sample used for this study consisted of 1,478 samples. The final sample size and the P1 and P2 values from previous research, with α = 5%, yielded a statistical power (1-β) of 99.9% in this study. This indicates that the probability of not committing a Type II error (not rejecting H0 when H0 is actually false) in this study is 99.9%. This very high statistical power is influenced by the final sample size being larger than the minimum calculated sample size.

The research instruments used from the 2018-2019 IBBS data, obtained from the Directorate of Prevention and Control of Infectious Diseases, Ministry of Health, included monitoring forms and behavioral questionnaires. The monitoring forms were used to track the collection, delivery, and examination of biological specimens, and consisted three types: specimen delivery forms, specimen collection forms, and laboratory examination result recording forms. Meanwhile, the behavioral questionnaires were designed separately for each key population, and included multiple questions related to risk behaviors.[11]

The variables analyzed in this study were selected based on previous research findings and the availability of variables in the 2018-2019 IBBS data. HIV/HCV coinfection status served as the dependent variable, determined based on serological testing results for both HIV and HCV antibodies included in the 2018–2019 IBBS dataset. A binary outcome variable was constructed in which individuals who tested reactive for both infections were coded as 1, and those with a non-reactive result for either or both were coded as 0. The analysis included only respondents with complete test results for both infections to ensure data validity and comparability. Meanwhile, needle-sharing behavior served as the primary independent variable, measured using a behavioral questionnaire from Block 6 (Injecting Drug Use), Item 609, which asked: “The last time you injected with others (excluding today), did you give your used needle to someone else (sharing)?” Responses indicating “Yes” were coded as having ever shared needles. The study also controlled for covariate variables, including age, gender, education level, marital status, and living partners obtained from the demographic section of the questionnaire; history of incarceration from the injecting drug use behavior section in prison; age at first injection and duration of injecting drug use from the injecting drug use behavior section; history of selling sex and condom use when selling sex from the sexual behavior section; and access to Needle and Syringe Programmes (NSPs) and access to Methadone Maintenance Therapy (MMT) from the program coverage section.

The analysis was conducted using univariate analysis to determine the prevalence of HIV/HCV coinfection in West Java Province and the frequency distribution of risk factors. Bivariate analysis was then performed using Chi-square and Cox regression tests, followed by multivariate analysis using Cox regression tests. At the bivariate analysis stage, the researcher examined the relationship between the independent and dependent variables. The chi-square test was used in this study to assess the association between two categorical variables, with a 95% confidence level. Additionally, Cox regression was employed for variables with more than two

categories to generate Crude Prevalence Ratios (PR). If the test results show a p-value > 0.05, the conclusion is that the null hypothesis ($H_0$) is rejected, indicating a significant relationship between the two variables. Conversely, if the p-value < 0.05, the conclusion is that $H_0$ is accepted, meaning there is no significant relationship between the two variables. The measure of association used to assess the relationship between the independent and dependent variables was the Prevalence Ratio (PR). In this study, multivariate analysis was conducted to validate the association between needle-sharing behavior and HIV/HCV coinfection among people who inject drugs (PWID) in West Java Province, while controlling for covariate variables. Prior to the multivariate analysis, a stratification analysis was performed to identify any potential interaction candidates between the independent variable and the covariates. If interaction candidate variables were found, they were included in the multivariate model, followed by interaction testing, in which interaction candidates with a p-value > 0.05 were eliminated. After the interaction test, a confounding test was conducted by eliminating covariate variables one by one, starting with the variable whose PR value was closest to the null value. If the difference in the main variable's PR value before and after elimination exceeded 10%, the variable was retained in the model and considered a confounder. This research was conducted based on the approval of the Research Ethics Committee of UPN "Veteran" Jakarta with Approval Number 491/XI/2024/KEP.

## Results

Table 1 shows that out of 1,478 study subjects, 100 were reactive for both Anti-HIV and Anti-HCV test results, resulting in an overall HIV/HCV coinfection prevalence of 6.8% among injecting drug users (IDUs) in West Java Province. The prevalence rates across the seven regencies and cities that conducted both tests vary considerably, indicating regional disparities in HIV/HCV coinfection. Four regencies/cities (Bogor Regency, Sukabumi Regency, West Bandung Regency, and Bandung City) have an HIV/HCV coinfection prevalence below the provincial prevalence (6.8%). Meanwhile, the other three cities (Sukabumi City, Bekasi City, and Depok City) have a prevalence above the provincial prevalence. These findings highlight regional differences in HIV/HCV prevalence. A detailed summary of the prevalence rates across regencies/cities is presented in Table 1.

**Table 1. Prevalence of HIV/HCV Coinfection Among Injecting Drug Users in West Java Province**

| Region | HIV/HCV Coinfection Status | | Prevalence (%) |
|---|---|---|---|
| | Non reactive | Reactive | |
| **West Java Province** | **1,378** | **100** | **6.8** |
| Bogor Regency | 203 | 12 | 5.5 |
| Sukabumi Regency | 172 | 1 | 0.6 |
| West Bandung Regency | 213 | 7 | 3.2 |
| Sukabumi City | 184 | 32 | 14.8 |
| Bandung City | 213 | 4 | 1.8 |
| Bekasi City | 194 | 22 | 10.2 |
| Depok City | 196 | 22 | 10.1 |

**Source:** Univariate analysis result, processed by the author (2025)

Table 2 shows that most IDUs respondents fall into the 25-49 age category (74.1%). The majority of IDUs are male (94.5%). Most IDUs have their highest level of education at the senior high school level (61.4%). The marital status of IDUs is predominantly unmarried (45%). The highest percentage of IDUs live with their families, accounting for 58%. Most IDUs do not have a history of incarceration due to drug use, with a percentage reaching 86.5%. The majority of IDUs first injected drugs at the age of 20 or older (53.7%). The most common injection duration among IDUs is ≥5 years (57.4%). The percentage of IDUs who shared needles during their last injection (excluding the day of the survey) is 86.5%. Only 1.6% (n=22) of IDUs reported engaging in transactional sex in the past year leading up to the survey. Among those with a history of sold sex, most used condoms while engaging in transactional sex (63.6%). Most IDUs did not access the Needle and Syringe Programmes (NSPs) to obtain sterile needles/syringes (51.7%). Additionally, the majority of IDUs were not enrolled in the Methadone Maintenance Therapy (MMT) at the time of the survey (82.9%).

These characteristics highlight the vulnerability of IDUs to HIV/HCV transmission. The predominance of young to middle-aged males with a long history of drug injection and limited participation in harm reduction programs, such as NSPs and MMT, suggests ongoing high-risk behaviors. Furthermore, the low rate of condomless transactional sex compared to the high prevalence of needle sharing indicates that unsafe injection practices remain the primary driver of infection risk in this population. These findings emphasize the need for targeted harm reduction interventions that address unsafe injection practices and promote greater access to preventive services. Without strengthened harm reduction strategies, the persistence of these risk behaviors may continue to sustain high rates of HIV/HCV coinfection among IDUs.

**Table 2. Frequency Distribution of Risk Factors for HIV/HCV Coinfection Among Injecting Drug Users in West Java Province**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Age** | | |
| 15-19 years | 109 | 7.4 |
| 20-24 years | 246 | 16.6 |
| 25-49 years | 1,096 | 74.2 |
| ≥50 years | 27 | 1.8 |
| **Gender** | | |
| Female | 81 | 5.5 |
| Male | 1,397 | 94.5 |
| **Education Level** | | |
| College/University | 7 | 0.5 |
| High School | 106 | 7.2 |
| Junior High School | 308 | 20.8 |
| Elementary School | 907 | 61.4 |
| Never went to school | 150 | 10.1 |
| **Marital Status** | | |
| Divorced | 232 | 15.7 |
| Married | 581 | 39.3 |
| Unmarried | 665 | 45.0 |
| **Living Partners** | | |
| Alone | 116 | 7,9 |
| With friends | 61 | 4,1 |
| With partner | 444 | 30.0 |
| With family | 857 | 58.0 |
| **History of Incarceration** | | |
| No | 1,279 | 86.5 |
| Yes | 199 | 13.5 |
| **Age of First Injecting Drug Use** | | |
| < 20 years | 685 | 46.4 |
| ≥ 20 years | 793 | 53.7 |
| **Duration of Injecting Drug Use** | | |
| < 5 years | 629 | 42.6 |
| ≥ 5 years | 849 | 57.4 |
| **Needle-sharing Behavior** | | |
| No | 199 | 13.5 |
| Yes | 1,279 | 86.5 |
| **History of Sold Sex**[a] | | |
| Yes | 22 | 1.6 |
| No | 1,346 | 98.4 |
| **Condom Use When Sold Sex**[b] | | |
| Yes | 14 | 63.6 |
| No | 8 | 36.4 |
| **Access to NSPs**[c] | | |
| Yes | 483 | 48.3 |
| No | 517 | 51.7 |
| **Access to MMT**[d] | | |
| Yes | 93 | 17.1 |
| No | 451 | 82.9 |

**a.** *Missing* 110 (7.4%), **b.** *Missing* 1,456 (98.5%), **c.** *Missing* 478 (32.3%), **d.** *Missing* 934 (63.2%)

Table 3 shows the Crude PR value for the needle-sharing behavior variable as 1.26 (95% CI: 0.69–2.31) with a p-value > 0.05, indicating that needle-sharing behavior among people who

inject drugs increases the risk of HIV/HCV coinfection in this population by 1.26 times. However, this association is not statistically significant, as the p-value is greater than 0.05.

**Table 3. Bivariate Analysis Result of The Association Between Needle-Sharing Behavior and HIV/HCV Coinfection**

| Variable | HIV/HCV Coinfection | | | | Total | | Crude PR (95% CI) | *P-value* |
|---|---|---|---|---|---|---|---|---|
| | Non reactive | | Reactive | | | | | |
| | n | % | n | % | n | % | | |
| **Needle-sharing Behavior** | | | | | | | | |
| No | 188 | 94.5 | 11 | 5.5 | 199 | 100.0 | Ref | |
| Yes | 1,190 | 93.0 | 89 | 7.0 | 1,279 | 100.0 | 1.26 (0.69–2.31) | 0.454 |
| **Age** | | | | | | | | |
| <25 years | 353 | 99.4 | 2 | 0.6 | 355 | 100.0 | Ref | |
| ≥25 years | 1,025 | 91.3 | 98 | 8.7 | 1,123 | 100.0 | 15.5 (3.84–62.5) | <0.001 |
| **Gender** | | | | | | | | |
| Female | 80 | 98.8 | 1 | 1.2 | 81 | 100.0 | Ref | |
| Male | 1,298 | 92.9 | 99 | 7.1 | 1,397 | 100.0 | 5.74 (0.81–40.6) | 0.041 |
| **Education Level** | | | | | | | | |
| High (High School and College/University | 112 | 99.1 | 1 | 0.9 | 113 | 100.0 | Ref | |
| Low (Never went to school, Elementary School, and Junior High School) | 1,266 | 92.8 | 99 | 7.2 | 1,365 | 100.0 | 8.19 (1.15–58.21) | <0.001 |
| **Marital Status** | | | | | | | | |
| Divorced | 211 | 90.9 | 21 | 9.1 | 232 | 100.0 | Ref | |
| Married | 520 | 89.5 | 61 | 10.5 | 581 | 100.0 | 1.15 (0.70–1.90) | 0.558 |
| Unmarried | 647 | 97.3 | 18 | 2.7 | 665 | 100.0 | 0.29 (0.15–0.56) | <0.001 |
| **Living Partners** | | | | | | | | |
| Alone | 111 | 95.7 | 5 | 4.3 | 116 | 100.0 | Ref | |
| With friends | 58 | 95.1 | 3 | 4.9 | 61 | 100.0 | 1.14 (0.27–4.77) | 0.857 |
| With partner | 406 | 91.4 | 38 | 8.6 | 444 | 100.0 | 1.98 (0.78–5.04) | 0.149 |
| With family | 803 | 93.7 | 54 | 6.3 | 857 | 100.0 | 1.46 (0.58–3.65) | 0.417 |
| **History of Incarceration** | | | | | | | | |
| No | 1,221 | 95.5 | 58 | 4.5 | 1,279 | 100.0 | Ref | |
| Yes | 157 | 78.9 | 42 | 21.1 | 199 | 100.0 | 4.65 (3.22–6.72) | <0.001 |
| **Age of First Injecting Drug Use** | | | | | | | | |
| < 20 years | 622 | 90.8 | 63 | 9.2 | 685 | 100.0 | Ref | |
| ≥ 20 years | 756 | 95.3 | 37 | 4.7 | 793 | 100.0 | 0.50 (0.34–0.75) | <0.001 |
| **Duration of Injecting Drug Use** | | | | | | | | |
| < 5 years | 620 | 98.6 | 9 | 1.4 | 629 | 100.0 | Ref | |
| ≥ 5 years | 758 | 89.3 | 91 | 10.7 | 849 | 100.0 | 7.49 (3.80–14.74) | <0.001 |
| **History of Sold Sex**[a] | | | | | | | | |
| Yes | 20 | 90.9 | 2 | 9.1 | 22 | 100.0 | Ref | |
| No | 1,250 | 92.9 | 96 | 7.1 | 1,346 | 100.0 | 1.27 (0.31–5.17) | 0.734 |
| **Condom Use When Sold Sex** [b] | | | | | | | | |
| Yes | 13 | 87.5 | 1 | 7.1 | 14 | 100.0 | Ref | |
| No | 7 | 92.9 | 1 | 12.5 | 8 | 100.0 | 1.74 (0.10–27.9) | 0.692 |
| **Access to NSPs**[c] | | | | | | | | |
| Yes | 434 | 89.9 | 49 | 10.1 | 483 | 100.0 | Ref | |
| No | 496 | 95.9 | 21 | 4.1 | 517 | 100.0 | 0.40 (0.24–0.66) | <0.001 |
| **Access to MMT**[d] | | | | | | | | |
| Yes | 70 | 75.3 | 23 | 24.7 | 93 | 100.0 | Ref | |
| No | 403 | 89.4 | 48 | 10.6 | 451 | 100.0 | 0.43 (0.26–0.70) | <0.001 |

**a.** *Missing* 110 (7.4%), **b.** *Missing* 1,456 (98.5%), **c.** *Missing* 478 (32.3%), **d.** *Missing* 934 (63.2%)

As shown in Table 4, stratified analysis identified five covariates (age, sex, education, history of selling sex, and access to LASS) as potential modifiers of the association between needle-sharing and HIV/HCV coinfection among PWID ($p < 0.05$).

**Table 4. The Association Between Needle-Sharing Behavior and HIV/HCV Coinfection After Stratified by Covariate Variables**

| Variable | Stratum-specific PR (95% CI) | Adjusted PR | P test of Homogenity Value | Difference Between Crude and Adjusted PR |
|---|---|---|---|---|
| **Age** | | | | |
| <25 years | 1.16 (1.11–1.22) | | | |
| ≥25 years | 1.02 (0.95–1.10) | 1.02 | <0.001 | 0.27% |
| **Gender** | | | | |
| Female | 1.35 (1.18–1.54) | | | |
| Male | 1.02 (0.94–1.09) | 1.02 | <0.001 | 0.72% |
| **Education Level** | | | | |
| High (High School and College/University | 1.16 (1.08–1.25) | | | |
| Low (Never went to school, Elementary School, and Junior High School) | 1.02 (0.95–1.10) | 1.03 | <0.001 | 0.04% |
| **Marital Status** | | | | |
| Divorced | 0.95 (0.76–1.18) | | | |
| Married | 1.02 (0.93–1.11) | | | |
| Unmarried | 1.10 (0.98–1.24) | 1.02 | 0.362 | 0.56% |
| **Living Partners** | | | | |
| Alone | 0.95 (0.61–1.49) | | | |
| With friends | 1.18 (1.06–1.32) | | | |
| With partner | 0.98 (0.85–1.13) | | | |
| With family | 1.06 (0.98–1.15) | 1.03 | 0.068 | -0.02% |
| **History of Incarceration** | | | | |
| No | 1.00 (0.90–1.11) | | | |
| Yes | 1.01 (0.91–1.11) | 1.00 | 0.930 | 2.17% |
| **Age of First Injecting Drug Use** | | | | |
| < 20 years | 1.05 (0.99–1.12) | | | |
| ≥ 20 years | 0.94 (0.79–1.11) | 1.01 | 0.114 | 1.51% |
| **Duration of Injecting Drug Use** | | | | |
| < 5 years | 0.97 (0.68–1.38) | | | |
| ≥ 5 years | 0.98 (0.91–1.05) | 0.98 | 0.945 | 4.82% |
| **History of Sold Sex**[a] | | | | |
| Yes | 1.02 (0.95–1.10) | | | |
| No | 1.11 (0.96–1.28) | 1.03 | 0.004 | 0.02% |
| **Condom Use When Sold Sex**[b] | | | | |
| Yes | 1.08 (0.92–1.26) | | | |
| No | 1.16 (0.86–1.57) | 1.03 | 0.594 | 0.00% |
| **Access to NSPs**[c] | | | | |
| Yes | 0.97 (0.88–1.07) | | | |
| No | 1.07 (1.05–1.10) | 1.02 | <0.001 | 0.34% |
| **Access to MMT**[d] | | | | |
| Yes | 0.98 (0.82–1.17) | | | |
| No | 1.02 (0.94–1.10) | 1.00 | 0.847 | 2.60% |

**a.** *Missing* 110 (7.4%), **b.** *Missing* 1,456 (98.5%), **c.** *Missing* 478 (32.3%), **d.** *Missing* 934 (63.2%)

Multivariate analysis was conducted to examine the relationship between independent and dependent variables after controlling for covariate variables, including age, gender, education level, marital status, living companions, history of incarceration, age at first drug injection, duration of drug injection, history of sold sex, condom use during sold sex, access to the Sterile Needle and Syringe Program (LASS), and access to the Methadone Maintenance Therapy (MMT). Multivariate modeling in this study used the Cox regression test to determine the relationship between needle-sharing behavior and HIV/HCV coinfection by incorporating the main independent variable, covariate variables, and candidate interaction variables.

Next, an interaction test was performed by eliminating candidate interaction variables one by one based on a p-value > 0.05, starting with interaction variables that had no p-value, namely Needle-Sharing Behavior*Access to NSPs and Needle-Sharing Behavior*History of Sold Sex. The elimination continued with candidate interaction variables with the highest p-values, namely Needle-Sharing Behavior*Age, Needle-Sharing Behavior*Gender, and Needle-Sharing Behavior*Education Level. All candidate interaction variables were eliminated from the model, as two variables had no p-value and the remaining three had p-values greater than 0.05. Therefore, no interaction variables were included in the final model.

**Table 5. Gold Standard Model of Cox Regression Multivariate Analysis**

| Variable | Prevalence Ratio | P-value | SE | Z | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Needle-sharing Behavior | 0.72 | 0.332 | 0.240 | -0.97 | 0.37 | 1.38 |
| Age | 5.27 | 0.027 | 3.97 | 2.20 | 1.20 | 23.13 |
| Gender | 3.33 | 0.235 | 3.37 | 1.19 | 0.45 | 24.30 |
| Education Level | 3.36 | 0.232 | 3.42 | 1.19 | 0.45 | 24.70 |
| Marital Status | | | | | | |
| Married | 1.08 | 0.796 | 0.33 | 0.26 | 0.59 | 1.96 |
| Unmarried | 0.49 | 0.039 | 0.16 | -2.07 | 0.25 | 0.96 |
| Living Partners | | | | | | |
| With friends | 2.26 | 0.265 | 1.66 | 1.12 | 0.53 | 9.57 |
| With partner | 1.14 | 0.793 | 0.59 | 0.26 | 0.41 | 3.15 |
| With family | 1.26 | 0.626 | 0.61 | 0.49 | 0.49 | 3.26 |
| History of Incarceration | 2.05 | 0.001 | 0.45 | 3.25 | 1.33 | 3.17 |
| Age of First Injecting Drug Use | 0.55 | 0.008 | 0.12 | -2.64 | 0.35 | 0.86 |
| Duration of Injecting Drug Use | 2.50 | 0.016 | 0.95 | 2.40 | 1.18 | 5.31 |
| History of Sold Sex | 1.20 | 0.857 | 1.22 | 0.18 | 0.16 | 8.80 |
| Condom Use When Sold Sex | 3.69 | 0.360 | 5.26 | 0.92 | 0.22 | 60.43 |
| Access to NSPs | 0.64 | 0.124 | 0.18 | -1.45 | 0.37 | 1.12 |
| Access to MMT | 0.51 | 0.014 | 0.13 | -2.46 | 0.30 | 0.87 |

Table 5 represents the gold standard model of multivariate analysis after conducting the interaction candidate test, which includes the relationship between the dependent variable (HIV/HCV coinfection status) and the independent variable (needle-sharing behavior), controlled by covariate variables. The prevalence ratio (PR) obtained in this model is 0.72 and is used as the comparison PR in the confounder test. To better illustrate these findings, the detailed output of the multivariate analysis is shown in Table 5.

Table 6 presents the fitted multivariate Cox regression model analyzing the relationship between needle-sharing behavior and HIV/HCV coinfection among people who inject drugs (PWID). The adjusted prevalence ratio (PR) for needle-sharing behavior is 0.77 (95% CI: 0.41–1.45), indicating that needle-sharing behavior is protective and may reduce the risk of HIV/HCV coinfection among PWID by 0.77 times. However, since the resulting p-value is 0.42 (>0.05), this relationship is not statistically significant. After controlling for confounding variables, three variables were identified as confounders in this study. The first is gender, with an adjusted PR of 2.8 (95% CI: 0.38–20.29), suggesting that gender increases the risk of HIV/HCV coinfection among PWID by 2.8 times. However, the p-value of 0.307 indicates that this relationship is not statistically significant. The wide confidence interval (CI) range, which includes the null value, suggests that the estimate is imprecise. The second confounder is a history of incarceration, with an adjusted PR of 3.29 (95% CI: 2.19–4.93) and a p-value of <0.001 (<0.05), indicating that a history of incarceration is significantly associated with HIV/HCV coinfection among PWID and increases the risk by 3.29 times. Similarly, the duration of drug injection is also a significant confounder, with an adjusted PR of 5.78 (95% CI: 2.87–11.64) and a p-value of <0.001 (<0.05), suggesting that a longer duration of drug injection is significantly associated with HIV/HCV coinfection among PWID and increases the risk by 5.78 times. However, the wide CI range also indicates that the estimate may lack precision.

**Table 6. Fitted Model of Cox Regression Multivariate Analysis**

| Variable | Prevalence Ratio | P-value | SE | Z | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| History of Incarceration | 3.29 | <0.001 | 0.67 | 5.79 | 2.19 | 4.93 |
| Duration of Injecting Drug Use | 5.78 | <0.001 | 2.06 | 4.92 | 2.87 | 11.64 |
| Needle-sharing Behavior | 0.77 | 0.424 | 0.24 | -0.80 | 0.41 | 1.45 |
| Gender | 2.80 | 0.307 | 2.83 | 1.02 | 0.38 | 20.29 |

## Discussion

Needle-sharing behavior is a prevalent practice among Injecting Drug Users (IDUs). The 2018–2019 Integrated Biological and Behavioral Survey (IBBS) found that 41% of IDUs shared needles in the month leading up to the survey. This indicates that needle-sharing is a common practice within the IDUs population.[11] This habit is one of the high-risk injection behaviors, as it serves as a transmission route for bloodborne diseases such as HIV and Hepatitis.[7] The Centers for Disease Control and Prevention (CDC) states that sharing needles or other equipment for injecting drugs places an individual at high risk of contracting or transmitting HIV and other infections.[12]

The fitted Cox regression analysis model indicates that the relationship between needle-sharing behavior and HIV/HCV coinfection among Injecting Drug Users (IDUs) is influenced by confounders, namely gender, history of incarceration, and duration of drug injection. Furthermore,

this study indicate that the association between needle-sharing behavior and HIV/HCV coinfection among IDUs is not statistically significant (APR: 0.77; 95% CI: 0.41–1.45; p-value = 0.424) as the p-value is greater than 0.05, means that the null hypothesis ($H_0$) fails to be rejected, and the confidence interval (CI) range includes the null value. Within the analytical context of this study, there is insufficient statistical evidence to support the hypothesis of a significant association between needle-sharing behavior and HIV/HCV coinfection. However, it is important to note that a non-significant result does not imply the absence of a relationship, but rather that the relationship is not confirmed statistically based on the current data. These findings align with a study conducted in Mozambique, which found that IDUs who shared injection equipment in the past month exhibited a protective effect but were not significantly associated with HIV/HCV coinfection (aOR: 0.53; 95% CI: 0.4–1.1; p-value = 0.08).[15] However, these findings are not consistent with a study conducted in Vietnam, which found that Injecting Drug Users (IDUs) who share needles have a 5.17 times higher risk of experiencing HIV/HCV coinfection (OR: 5.17; 95% CI: 2.69–9.93) compared to those who do not share needles.[16] This difference in results may be due to variations in the study periods. The measurement of needle-sharing behavior for 2018-2019 IBBS was limited to a single time point, namely the respondent's most recent injection event. This narrow observation window may not accurately capture the respondent's overall pattern of high-risk injection behaviors, potentially underestimating their exposure to bloodborne infections. Similarly, the study in Mozambique collected needle-sharing history only for the past month before data collection. Meanwhile, the study in Vietnam measured high-risk behaviors over the participants' lifetime, including before and during data collection. A longer observation period for needle-sharing behavior among IDUs may provide a greater opportunity to assess how this behavior consistently contributes to the risk of HIV/HCV coinfection.[15,16] Another factor to consider is reporting bias. Behavioral data were collected through structured interviews, which are susceptible to social desirability bias, where respondents may underreport risky behaviors like needle sharing to present themselves more favorably to interviewers. This can lead to misclassification and underestimation of the true association between needle sharing and coinfection.[19]

The relationship between needle-sharing behavior and HIV/HCV coinfection among Injecting Drug Users (IDUs) is influenced by several confounders. The first confounder is gender, where being male was found to increase the risk of HIV/HCV coinfection among IDUs by 2.8 times (APR: 2.80; 95% CI: 0.38–20.29; p-value = 0.307) compared to females. These findings are consistent with a study in Vietnam, which found that being male increased the risk of HIV/HCV coinfection among IDUs by 7.69 times (OR: 7.69; 95% CI: 4.20–14.06) compared to females.[16] A study conducted on male IDUs in Vietnam stated that they are vulnerable to contracting HIV and Hepatitis C through blood due to their needle-sharing habits.[20] Male IDUs often encourage and assist their female partners in injecting drugs and teach them needle-sharing behavior.[11] However,

the relationship between IDUs gender and HIV/HCV coinfection in this study was not statistically significant, as the p-value was greater than 0.05 and the confidence interval (CI) range crossed the null value. The wide CI range indicates that the estimated relationship lacks precision.[21] The wide CI range may be due to the high variability in the gender variable. This variability is caused by the imbalance in distribution, with a significantly higher number of male IDUs compared to female IDUs. Although the majority of respondents in this study were male, previous findings from the 2018–2019 IBBS indicate that female IDUs may actually be more vulnerable to bloodborne infections such as HIV and HCV. The report highlights that male partners often assist women during their first injection experience and commonly share injection equipment with them. This dynamic may place women at higher risk of infection, not necessarily due to higher frequency of injection, but due to the nature of their initiation and dependency on male partners for injecting practices. Consequently, gender may act not only as a confounder but also as an effect modifier, influencing both risk exposure and outcomes in different ways for men and women. The underrepresentation of female IDUs in this study may therefore obscure these gendered risk patterns.[11]

Another confounding variable identified in this study is a history of incarceration. Injecting Drug Users (IDUs) with a history of incarceration due to drug use have a 3.29 times higher risk (APR: 3.29; 95% CI 2.19–4.93; p-value <0.001) of experiencing HIV/HCV coinfection compared to those without a history of incarceration due to drug use. This finding aligns with a study in Kenya, which found that a history of incarceration among IDUs increased the risk of HIV/HCV coinfection among IDUs in Coastal Kenya by 2.69 times (OR: 2.69; 95% CI 1.17–7.22).[13] This variable was found to have the most significant association with the occurrence of HIV/HCV coinfection among IDUs in this study. Injecting drugs while in prison is associated with an increased risk of bloodborne disease transmission, such as HIV and Hepatitis C, among inmates due to inadequate access to sterile injecting equipment. This risk is not only present during incarceration but also persists after release. During the post-release period, IDUs often struggle to access adequate medical care for addiction treatment, receive social support, and obtain economic resources, which ultimately drives them to resume injecting drug use—even in public spaces. These conditions increase needle-sharing practices, thereby elevating the risk of bloodborne disease transmission.[22,23]

The duration of injecting drug use is also a confounder in the relationship between needle-sharing behavior and the occurrence of HIV/HCV coinfection among IDUs in West Java Province. The multivariate analysis model fit shows that IDUs who have been injecting drugs for more than five years have a 5.78 times higher risk (APR: 5.78; 95% CI 2.87–11.64; p-value <0.001) of experiencing HIV/HCV coinfection compared to those who have been injecting for less than five

years. This finding is consistent with a study in Tanzania, which found that the duration of injecting drug use among IDUs is associated with an increased risk of HIV/HCV coinfection in this population. The study reported that IDUs who had been injecting drugs for 7–9 years and 10 years or more had a 3.41 times (95% CI 1.04–11.14) and 2.96 times (95% CI 1.00–9.13) higher risk of experiencing HIV/HCV coinfection, respectively.[14] The longer a person injects drugs, the more frequently they are exposed to syringes contaminated with HIV and Hepatitis viruses.[11] Additionally, the likelihood of interacting with or sharing needles with other IDUs (injecting partners) also increases. If these high-risk injecting behaviors continue, the risk of exposure to infectious diseases such as HIV and Hepatitis C will continue to rise.[23] However, the relatively wide CI range indicates that the observed relationship lacks precision.

These findings highlight the importance of strengthening harm reduction services within correctional facilities. Given the significant association between incarceration history and HIV/HCV coinfection, policies should prioritize improving access to HIV and HCV screening and treatment in prisons, as well as integrating NSP and methadone maintenance therapy (MMT) into prison health programs. In addition, implementing reintegration programs that provide direct referral to health services upon release could support continuity of care and reduce community-level transmission risks. From a policy perspective, these findings suggest the need to shift programmatic focus beyond needle-sharing behaviors and toward structural vulnerabilities such as incarceration history and duration of drug use. Expanding access to integrated harm reduction and treatment programs, both within correctional facilities and in post-release settings, is critical. Community-based support systems must also be strengthened to ensure continuity of care and reduce stigma against formerly incarcerated IDUs, enabling better reintegration and sustained access to services.

There are several limitations and strengths identified in this study. The data collection for 2018–2019 IBBS, conducted through interviews using a questionnaire instrument, presents the possibility of the Clever Hans effect, where respondents may provide answers they believe will please the enumerators. However, the use of a structured questionnaire instrument in this method ensures a consistent standard in collecting information from respondents, thereby minimizing variability between enumerators. Another limitation relates to the cross-sectional study design used in this research, which is prone to temporal ambiguity because exposure and outcome are measured simultaneously, making it difficult to determine which occurred first.[24,25] However, with this study design, the research can be conducted in a relatively short time and more efficiently, as is the advantage of the cross-sectional study design, while still providing important insights into risk factor patterns.[26] The 2018–2019 IBBS data used in this study is five years old since the research was conducted, meaning it does not reflect the most recent biological and behavioral data of IDUs. As a result, the findings may not fully represent the current risks or needs of the population.

However, the data remains relevant in providing an overview of the biological and behavioral conditions of IDUs at that time. The sampling method used in 2018–2019 IBBS for the IDUs population was Respondent Driven Sampling, a form of snowball sampling that is prone to selection bias, as respondents tend to recommend individuals with similar characteristics to themselves. This may lead to a sample that does not fully represent the population.[27]

## Conclusion

The prevalence of HIV/HCV coinfection among IDUs in West Java Province is 6.8%. Based on data from seven regencies/cities in West Java Province, four regencies/cities had a prevalence rate below 6.8% (Bogor Regency, Sukabumi Regency, West Bandung Regency, and Bandung City), while the prevalence in the other three cities was above 6.8% (Sukabumi City, Bekasi City, and Depok City). The results of the multivariate Cox regression analysis showed no significant relationship between needle-sharing behavior and HIV/HCV coinfection among IDUs in West Java Province. This relationship was influenced by confounding variables, namely gender, history of incarceration, and duration of drug injection. Among these, a history of incarceration was the most significant confounder associated with HIV/HCV coinfection among IDUs in West Java Province. Although the findings do not confirm the initial hypothesis, they contribute to the growing body of literature highlighting the need for harm reduction strategies that address long-term behavioral and systemic risk factors. The study also underscores the importance of expanding healthcare and rehabilitation services within correctional facilities and ensuring post-incarceration continuity of care. Future research should explore these associations in more depth using updated data and longitudinal or case-control study designs to better capture causal relationships. Further investigation is also needed to assess how social and structural determinants influence the effectiveness of current HIV/HCV prevention programs among IDUs in West Java Province.

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The authors have no conflict of interest in this research.

## Reference


1. Yakubu A, Hali B, Maiyaki AS. Prevalence and Risk Factors for Hepatitis C Virus Co-infection among Human Immunodeficiency Virus-Infected Patients and Effect of Hepatitis C Virus Infection on Acquired Immunodeficiency Syndrome Cases at Baseline [Internet]. Vol. 20, Annals of African Medicine. 2021. p. 297–301. Available from: http://dx.doi.org/10.4103/aam.aam_65_20
2. Shrestha LB, Yadav GK, Pradhan S, Sharma A, Pandit T, Chhetry R, et al. Co-infection of Hepatitis B and Hepatitis C among HIV-infected patients: A cross-sectional study from tertiary care hospital of eastern Nepal. PLoS One [Internet]. 2022;17(3):1–11. Available from: http://dx.doi.org/10.1371/journal.pone.0264791
3. WHO. HIV and AIDS [Internet]. 2023 [cited 2024 Mar 28]. Available from: https://www.who.int/news-room/fact-sheets/detail/hiv-aids
4. Choy CY, Ang LW, Ng OT, Leo YS, Wong CS. Factors associated with hepatitis B and C co-infection among HIV-infected patients in Singapore, 2006-2017. Trop Med Infect Dis [Internet]. 2019;4(2):1–15. Available from: http://dx.doi.org/10.3390/tropicalmed4020087
5. Kemenkes RI. Rencana Aksi Nasional Pengendalian Hepatitis 2020-2024 [Internet]. 2021. Available from: https://repository.kemkes.go.id/book/647
6. CDC. People with HIV/AIDS [Internet]. 2020 [cited 2024 Mar 28]. Available from: https://www.cdc.gov/hepatitis/hcp/populations-settings/hiv.html?CDC_AAref_Val=https://www.cdc.gov/hepatitis/populations/hiv.htm
7. National Institutes of Health. HIV and Opportunistic Infections, Coinfections, and Conditions [Internet]. 2021. Available from: https://hivinfo.nih.gov/understanding-hiv/fact-sheets/hiv-and-hepatitis-c
8. Akhtar A, Fatima S, Saeed H, Soo CT, Khan AH. HIV-HCV Coinfection: Prevalence and Treatment Outcomes in Malaysia. Intervirology [Internet]. 2022;65(2):87–93. Available from: http://dx.doi.org/10.1159/000518836
9. WHO. Global HIV, Hepatitis, and STIs Programmes: People Who Inject Drugs [Internet]. 2024 [cited 2024 Oct 9]. Available from: https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/populations/people-who-inject-drugs
10. Kemenkes RI. Supplement of IBBS Report Spesific Analysis 2018-2019 [Internet]. 2019. Available from: https://hivaids-pimsindonesia.or.id/download/file/2018-2019_IBBS_Report_Supplement_eng.pdf
11. Kemenkes RI. Integrated Biological & Behavioral Survey 2018-2019 [Internet]. 2019. Available from: https://hivaids-pimsindonesia.or.id/download/index/120
12. CDC. Injection Drug Use [Internet]. 2022 [cited 2024 Mar 28]. Available from: https://www.cdc.gov/hiv/risk/drugs/index.html

13. Akiyama MJ, Cleland CM, Lizcano JA, Cherutich P, Kurth AE. Prevalence, estimated incidence, risk behaviours, and genotypic distribution of hepatitis C virus among people who inject drugs accessing harm-reduction services in Kenya: a retrospective cohort study. Lancet Infect Dis [Internet]. 2019;1–9. Available from: http://dx.doi.org/10.1016/S1473-3099(19)30264-6
14. Leyna GH, Makyao N, Mwijage A, Ramadhan A, Likindikoki S, Mizinduko M, et al. HIV/HCV co-infection and associated risk factors among injecting drug users in Dar es Salaam, Tanzania: Potential for HCV elimination. Harm Reduct J [Internet]. 2019;16(68):1–10. Available from: http://dx.doi.org/10.1186/s12954-019-0346-y
15. Baltazar CS, Boothe M, Kellogg T, Ricardo P, Sathane I, Fazito E, et al. Prevalence and risk factors associated with HIV/hepatitis B and HIV/hepatitis C co-infections among people who inject drugs in Mozambique. BMC Public Health [Internet]. 2020;20(851):1–11. Available from: https://doi.org/10.1186/s12889-020-09012-w
16. Thinh VT, Li L, Matthieu D, Hoa VD, Anh NH, Giang LM. HCV and HIV co-infection among people who inject drugs in Vietnam. J Heal Soc Sci [Internet]. 2020;5(4):573–86. Available from: https://doi.org/10.19204/2020/hcvn13
17. Azzahra SN. Faktor-faktor yang Berhubungan dengan Kejadian Koinfeksi HIV/HCV pada Penasun (Pengguna Narkoba Suntik) di Tujuh Kabupaten/Kota Jawa Barat (Analisis Lanjut STBP 2018-2019) [Internet]. Universitas Indonesia. 2023. Available from: https://lontar.ui.ac.id/detail?id=9999920524928&lokasi=lokal
18. A'yunin Q, Bantas K. HUBUNGAN PENGGUNAAN NARKOTIKA SUNTIK DENGAN KOINFEKSI HEPATITIS C DI RSUD TEBET TAHUN 2017-2019. Junal Kesehat Indra Husada [Internet]. 2020;8(2):166–73. Available from: https://doi.org/10.36973/jkih.v8i2.220
19. Bergen N, Labonté R. "Everything Is Perfect, and We Have No Problems": Detecting and Limiting Social Desirability Bias in Qualitative Research. Qual Health Res. 2020;30(5):783–92.
20. Nadol P, O'Connor S, Duong H, Le LVN, Thang PH, Tram TH, et al. Findings from Integrated Behavioral and Biologic Survey among Males Who Inject Drugs (MWID)-Vietnam, 2009-2010: Evidence of the Need for an Integrated Response to HIV, Hepatitis B virus, and Hepatitis C virus. PLoS One [Internet]. 2015;10(2):1–17. Available from: https://doi.org/10.1371/journal.pone.0118304
21. Shreffler J, Huecker MR. Hypothesis Testing, P Values, Confidence Intervals, and Significance [Internet]. StatPearls. 2023. Available from: http://www.ncbi.nlm.nih.gov/pubmed/32491353
22. Bouck Z, Jain S, Sun X, Milloy MJ, Werb D, Hayashi K. Recent incarceration and risk of

first-time injection initiation assistance: A prospective cohort study of persons who inject drugs. Drug Alcohol Depend [Internet]. 2020;212:1–8. Available from: https://doi.org/10.1016/j.drugalcdep.2020.107983

23. Kakchapati S, Maharjan M, Rawal BB, Dixit SM. Social determinants and risk behaviors associated with prevalent Hepatitis C and HIV/HCV co-infection among male injection drug users in Nepal. Arch Public Heal [Internet]. 2017;75(39):1–10. Available from: https://doi.org/10.1186/s13690-017-0206-8
24. Kelly SE, Brooks SPJ, Benkhedda K, MacFarlane AJ, Greene-Finestone LS, Skidmore B, et al. A scoping review shows that no single existing risk of bias assessment tool considers all sources of bias for cross-sectional studies. J Clin Epidemiol [Internet]. 2024;172:1–16. Available from: https://doi.org/10.1016/j.jclinepi.2024.111408
25. Chirico F. Cross-sectional studies in occupational health research: An overview of strengths and limitations. Ital J Psychol Occup Heal [Internet]. 2023;3(3):86–93. Available from: https://doi.org/10.69088/2023/CRSS2
26. Abduh M, Alawiyah T, Apriansyah G, Sirodj RA, Afgani MW. Survey Design: Cross Sectional dalam Penelitian Kualitatif. J Pendidik Sains dan Komput [Internet]. 2023;3(1):31–9. Available from: https://doi.org/10.47709/jpsk.v3i01.1955
27. Pasikowski S. Snowball Sampling and Its Non-Trivial Nature. Educ Stud Rev [Internet]. 2023;43(2):105–20. Available from: https://doi.org/10.12775/pbe.2023.030