Factors associated with syphilis seropositive and Human Immunodeficiency Virus (HIV) infection among inmates at Lubuk Pakam prison, Indonesia

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Abstract. Syphilis has been known to increase the risk of acquiring or transmitting HIV infection. Epidemiologic studies showed that HIV transmission is 3-5 times higher in people with syphilis. Hence, in this current study, the factors associated with syphilis-seropositive and HIV infection were evaluated. This study used cross-sectional study. This study included inmates at Lubuk Pakam prison in November 2016. After interviewing participants’ demographics and risk behaviors, blood samples were obtained to be tested for HIV and syphilis, using the Rapid Test tool of HIV 3 methods and One STEP Syphilis Anti TP-Test. A total number of 1,114 inmates were included in this study, consisted of 1,081 male (97%) and 33 female (3%). Ten inmates were HIV-positive (0.9%), whereas 70 inmates were syphilis-seropositive (6.3%). Based on multivariate analyses, high-risk sexual behaviors associated with the increased risk of syphilis-seropositive of up to 8.31 times (p=0.002). HIV status also portrayed higher risk of syphilis-seropositive compared to non-HIV participants (3.98 fold, p=0.019). In HIV incidence, found that high-risk sexual behaviors also significantly increased the risk of HIV (7.69 fold, p=0.003). Syphilis-seropositive was also highly associated with HIV risk (5.09 fold, p=0.019). Syphilis and HIV showed a close association with several shared contributing factors.

1. Introduction
Until recently, syphilis remains to be a global health problem. Two millions of new cases were reported which continue to be rising all over the world1,2. In 2015, a total number of 23,873 cases of primary and secondary syphilis were in the United States, yielding a rate of 7.5 cases per 100,000 population3. In developing countries, like Indonesia, the similar rate was observed. Integrated biological and behavior survey conducted in 2011 showed that the prevalence of syphilis in Indonesia is also high. It was reported as high as 25% in the She-male population, 10% among female sex workers, 9% among Men who have Sex with Men (MSM) population, and 3% among intravenous drugs users4.

Several complications of syphilis have been studied, one of which is transmission and acquisition of HIV infection. Syphilis associated with an increased risk of HIV disease among both gay men and heterosexuals of up to 3 to 5 time higher5. Syphilis has also been reported to affect the course of HIV infection6. When occurs concomitantly, syphilis may cause further CD4 decline or may increase HIV viral load. Furthermore, genital ulcerations and inflammation caused by STDs are suggested being the cofactors for acquiring or transmitting HIV infection. These vulnerable ulcers caused by syphilis is
prone to bleeding when it comes into contact with oral and rectal mucosa during sex, hence the transmission of (and susceptibility to) HIV increases tremendously\textsuperscript{6,7,8}.

Since the importance of the disease has been documented, regular screening of syphilis and HIV has long been proposed especially within high-risk populations such as prison inmates. Early recognition hence treatment, are thought to limit the spread of syphilis and HIV as well as to prevent complications. Align with those considerations, in this study, the rate of syphilis seropositive and HIV infection, as well as the associating factors among inmates at Lubuk Pakam Prison, were evaluated.

2. Methods
This study used cross-sectional study design, which involved 1,114 inmates at Lubuk Pakam prison during the study period of November 2016. Background demographics and risk behaviors gather through an interview followed by obtaining venous blood samples. The samples have an examination for HIV and syphilis infections using the Rapid Test tool of HIV 3 methods and One STEP Syphilis Anti-TP Test. Collected data were pooled and analyzed for univariate, bivariate (Fisher-exact test, chi-square test), and multivariate (binary logistic regression) using SPSS with a significant level of $p<0.05$ (95% confidence interval).

3. Results
3.1. Subjects’ demography
A total number of 1,114 participants were in this study; of which consisted mostly of males (97%), and productive age persons (44.3% were 18-30 years old; while 35.4% were 31-40 years old). Education background varied with high school graduates being the most common (41.8%). Approximately 693 participants (62.2%) were married. Of all the subjects, ten people were with HIV (0.9%), and 70 people with syphilis seropositive (6.3%). Regarding habitual characteristics, 39.7% had a tattoo(s), 21.6% had a piercing(s), 23.9% had high-risk sexual activities, 1.3% had a history of intravenous drugs use, and 1.5% were Men who have Sex with Men (MSM).

| Variables                | N  | %   |
|--------------------------|----|-----|
| Age                      |    |     |
| 18-30 years old          | 493| 44.3|
| 31-40 years old          | 394| 35.4|
| 41-50 years old          | 164| 14.7|
| >50 years old            | 63 | 5.7 |
| Gender                   |    |     |
| Female                   | 33 | 3   |
| Male                     | 1,081| 97  |
| Education background     |    |     |
| Elementary school        | 277| 24.9|
| Junior school            | 340| 30.5|
| High school              | 466| 41.8|
| Universities             | 31 | 2.8 |
| Marital status           |    |     |
| Not married              | 421| 37.8|
| Married                  | 693| 62.2|
| Tattoo(s)                |    |     |
| Present                  | 442| 39.7|
| Absent                   | 672| 60.3|
| Piercing(s)              |    |     |
| Present                  | 241| 21.6|
| Absent                   | 873| 78.4|

Table 1. Participants’ baseline characteristics.
3.2. Factors associated with syphilis

Further analyses were conducted to evaluate the association between subjects’ demography with the occurrence of syphilis. Of all the characteristics, age, education, marital status, high-risk sexual behaviors, and HIV status showed significantly associated with syphilis (p<0.05). Of 227 subjects older than 40 years old, 10.1% had syphilis; while of 887 subjects younger than 40 years old, syphilis was lower (5.3%). This result implied younger age showed protective effect with the incidence of syphilis [PR = 0.523 (95% CI = 0.325-0.843)]. Lower education background (elementary/junior school) also showed higher risk (1.65 fold) of developing syphilis compared to higher education background (high school/universities).

In terms of marital status, unmarried subjects showed lower risk of syphilis [PR = 0.57 (95% CI = 0.338-0.960)]. Among 421 unmarried participants, 4.3% had syphilis versus 7.5% found within the married group. Syphilis risk was also found dramatically increased (21.61 fold) in subjects with high-risk sexual behaviors compared with they don't. Risk also increased in HIV subjects (6.69 fold). Other characteristics not explained above such as gender, tattoo, piercing, IV drugs use and MSM did not show significant association with the incidence of syphilis.

Table 2. Factors associated with syphilis.

|                  | Syphilis | Non-Syphilis | p-value | PR   | 95% CI        |
|------------------|----------|--------------|---------|------|---------------|
| **Age**          |          |              |         |      |               |
| 18 – 40 years old| 47       | 5.3%         | 840     | 94.7 |               |
| >40 years old    | 23       | 10.1%        | 204     | 89.9 |               |
| **Gender**       |          |              |         |      |               |
| Female           | 3        | 9.1%         | 30      | 90.9 |               |
| Male             | 67       | 6.2%         | 1,014   | 93.8 |               |
| **Education**    |          |              |         |      |               |
| High school     | 47       | 7.6%         | 570     | 92.4 |               |
| Junior schools   | 23       | 4.6%         | 474     | 95.4 |               |
| **Marital status** |        |              |         |      |               |
| Unmarried        | 18       | 4.3%         | 403     | 95.7 |               |
| Married          | 52       | 7.5%         | 641     | 92.5 |               |
| **Tattoo(s)**    |          |              |         |      |               |
| Present          | 29       | 6.6%         | 413     | 93.4 |               |
| Absent           | 41       | 6.1%         | 631     | 93.9 |               |
| **Piercing(s)**  |          |              |         |      |               |
| Present          | 14       | 5.8%         | 227     | 94.2 |               |
| Absent           | 56       | 6.4%         | 817     | 93.6 |               |
| **High-risk sex** |        |              |         |      |               |
| Present          | 61       | 22.9%        | 205     | 77.1 |               |
| Absent           | 9        | 1.1%         | 839     | 98.9 |               |
| **IV drugs use** |          |              |         |      |               |
| Present          | 1        | 6.7%         | 14      | 93.3 |               |
| Absent           | 69       | 6.3%         | 1,030   | 93.7 |               |
|                  | 1,114    | 100.0        |         |      |               |
3.3. Factors associated with HIV

This study also evaluates potentially contributing factors to the development of HIV. Based on this study, gender, high-risk sexual behaviors and syphilis status significantly associated with HIV. Among 33 female participants, 6.1% had HIV. This differs significantly with male participants, in which out of 1,081 males, only 0.7% had HIV. It suggests female is 8.19 times more likely to develop HIV than male. Risk increment was also in subjects with high-risk sexual activities (16.96 fold) as well as syphilis (9.94 fold). No association was between age, education, marital status, tattoo, piercing, IV drugs use and MSM with the incidence of HIV.

Table 3. Factors associated with HIV.

|                | HIV            | Non-HIV        | p-value | PR      | 95% CI       |
|----------------|----------------|----------------|---------|---------|--------------|
|                | N   | %    | n    | %    |           |             |
| Age            |     |      |      |      |            |             |
| 18 – 40 y o    | 9   | 1    | 878  | 99   | 0.697      | 2.303-18.086|
| >40 y o        | 1   | 0.4  | 226  | 99.6  |            |              |
| Gender         |     |      |      |      |            |             |
| Female         | 2   | 6.1  | 31   | 93.9  | 0.033      | 8.189        |
| Male           | 8   | 0.7  | 1,037| 99.3  |            | 1.809-37.082 |
| Education      |     |      |      |      |            |             |
| Elementary-Jr high school | 6 | 1    | 611  | 99.0  |            |              |
| University    | 4   | 0.8  | 493  | 99.2  | 0.999      | 1.208        |
| Marital status|     |      |      |      |            |             |
| Unmarried      | 5   | 1.2  | 416  | 98.8  | 0.516      | 1.646        |
| Married        | 5   | 0.7  | 688  | 99.3  |            | 0.479-5.652  |
| Tattoo(s)      |     |      |      |      |            |             |
| Present        | 5   | 1.1  | 437  | 98.9  | 0.530      | 1.520        |
| Absent         | 3   | 1.2  | 238  | 98.8  |            | 0.443-5.221  |
| Piercing(s)    |     |      |      |      |            |             |
| Present        | 7   | 0.8  | 866  | 99.2  | 0.458      | 1.552        |
| Absent         | 3   | 0.8  | 843  | 99.2  |            | 0.404-5.958  |
| High-risk sex  |     |      |      |      |            |             |
| Present        | 10  | 3.8  | 326  | 96.2  | <0.001     | 16.962       |
| Absent         | 0   | 0    | 848  | 100   |            | 8.940-37.986 |
| IV drugs use   |     |      |      |      |            |             |
| Present        | 0   | 0    | 15   | 100   | 0.999      | 1.009        |
| Absent         | 10  | 0.9  | 1,089| 99.1  |            | 1.003-1.015  |
| MSM            |     |      |      |      |            |             |
| Present        | 10  | 0.9  | 1,087| 99.1  | 0.999      | 1.009        |
| Absent         | 4   | 5.7  | 66   | 94.3  |            | 1.003-1.015  |
| HIV            |     |      |      |      |            |             |
| Present        | 6   | 0.6  | 1,038| 99.4  | 0.002      | 9.943        |
| Absent         | 10  | 0.9  | 1,089| 99.1  |            | 2.872-34.420 |

*p<0.05

3.4. Multivariate analyses of associated factors

Multivariate analyses were carried out to evaluate combined associating factors to the occurrence of syphilis and HIV (conducted individually). This study found high-risk sexual behaviors increased the risk of syphilis up to 8.31 times (p=0.002). HIV status also portrayed higher risk of syphilis compared to non-HIV persons (3.98 fold, p=0.019). There was no significant association between age group, marital status, education level and MSM with the incidence of syphilis. In terms of HIV incidence, current study found high-risk sexual behaviors also significantly increased the risk of HIV [PR = 7.697 (95% CI = 2.348–36.625); p=0.003]. Syphilis status was also highly associated with HIV risk [PR = 5.086 (95% CI = 1.354-12.536); p=0.019]. There was no significant association between genders with the incidence of HIV.
Table 4. Multivariate analyses of factors associated with syphilis.

| Variables          | $p$-value | PR (95% CI)       |
|--------------------|-----------|-------------------|
| High-risk sex      | 0.002*    | 8.314 (2.516-33.225) |
| HIV                | 0.019*    | 3.984 (1.531-15.623) |
| Age                | 0.431     | 0.923 (0.580-0.998)  |
| Marital status     | 0.697     | 1.089 (0.774-1.125)  |
| Education background| 0.799   | 1.066 (0.887-1.051)  |
| MSM                | 0.922     | 0.999 (0.911-1.021)  |

* $p<0.05$

Table 5. Multivariate analyses of factors associated with HIV.

| Variables   | $p$-value | PR (95% CI)       |
|-------------|-----------|-------------------|
| High-risk sex| 0.003*    | 7.697 (2.348-36.625) |
| Syphilis    | 0.019*    | 5.086 (1.354-12.536) |
| Gender      | 0.126     | 1.046 (1.002-1.151)  |

* $p<0.05$

4. Discussion

Early recognition of syphilis and HIV through regular screening has been proposed especially among high-risk population such as prison inmates. An Individual with syphilis is more likely to have HIV through a higher rate of genital ulcer transmission. However, well-documented studies evaluating HIV and syphilis co-infection and its associated risk factors are still limited. This current study shows the prevalence of HIV was 0.9% and 6.3% for syphilis seropositive, whereas the prevalence for co-infections was 0.4%. From multivariate-analyses, it showed that high-risk sexual behaviors increased the risk of syphilis seropositive of up to 8.31 times ($p=0.002$). HIV status also portrayed higher risk of syphilis seropositive compared to non-HIV persons (3.98 fold, $p=0.019$). In terms of HIV incidence, current study found high-risk sexual encounters also significantly increased the risk of HIV [PR = 7.697 (95% CI = 2.348–36.625); $p=0.003$]. Syphilis seropositive was also highly associated with HIV risk [PR = 5.086 (95% CI = 1.354-12.536); $p=0.019$].

The results of the current study were in line with available data. Study of prevalence and risk behavior among Prisoners in Prison and Detention Centers in Indonesia, conducted by Directorate of Correction Ministry of Justice and Human Rights in 2010, showed that the prevalence of HIV was five times higher in female (6%) than in male respondents (1.1%). Likewise, the prevalence of syphilis was 1.6 times higher in female (8.5%) than in male respondents (5.1%). One out of 10 HIV-positive male respondents (10%) were syphilis-seropositive compared to 6 of syphilis-seropositive among 24 HIV-positive female respondents (25%). Among male prisoners, significant risk factors ($p<0.05$) for HIV-positive were a history of IV drugs use, body piercing and having a genital accessory in prison. Meanwhile, the reported significant risk factors for female were being a history of IV drugs use, a history of tattoos, the age of 30 years or over and syphilis-positive. A study done by Yuhua et al (2007) evaluated the association between syphilis and HIV infections among MSM in Beijing, China suggested that HIV is significantly associated with syphilis seropositive (OR=3.8, 95% CI=1.3-10.8) By available evidence, this study suggested that syphilis acts as an important predictor of the occurrence of HIV. Since syphilis and HIV have been shown closely associated, people with syphilis should be tested for HIV and vice versa.

5. Conclusion

Syphilis and HIV showed the close association with several shared contributing factors. High-risk sexual behaviors and HIV status associated with the increased risk of syphilis seropositive. Inversely, high-risk sexual behaviors and syphilis seropositive associated with the increased risk of HIV infection.
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