Trend of HIV Incidence Rates Among Drug Users in an HIV Epicenter in Northern Thailand (1989-1997)

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Objectives: to determine trends and associated risk factors of HIV incidence (1989-1997) in a drug abuse treatment clinic in northern Thailand where HIV is epidemic

Design: retrospective cohort study

Methods: Nine-years (1989-1997) of data (excluding names) from the logbook of drug abusers seeking treatments in Mae Chan Hospital in Chiangrai Thailand, were transcribed and double-entered into separate computer files which were later validated against each other. For each patient, the dates of the first HIV negative, the last HIV negative, and the first HIV positive were determined. A retrospective cohort of drug users who were initially HIV-negative and treated for more than once was constructed. HIV seroconversion was assumed to follow a uniform distribution between the last negative and the first positive HIV tests. The incidence rates and their 95% confidence intervals (CI) were calculated.

Results: Of the 378 repeat patients, 16 (4.2%) HIV seroconverted. This is equivalent to 5.11 per 100 person-years of observation (PYO) (95%CI=3.13-8.35). The incidence remained relatively stable over the study period while the prevalence was on the decline. The younger, Thai lowlanders, drug injectors had higher incidence rates than the older, ethnic minorities and drug smokers, respectively.

Conclusion: Prevalence can give illusional results. It is necessary to know baseline HIV incidence to monitor and evaluate an HIV intervention program.

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HIV, incidence, drug users, estimation, trend

Substance abuse was recognized as a major risk factor for HIV infection in Thailand since early of the epidemic and the data from a study conducted in Bangkok Thailand showed that the incidence rates of HIV among injecting drug users (IDU) during 1987 and 1992 were in the range of 20-57 per 100 person-years of observation 2. The contribution of injecting drug use to HIV epidemic was well-recognized at international levels 2. Efforts are being made to control the epidemic. Exchange of syringe and needle and methadone maintenance are considered to be two major effective programs in combating HIV infection among substance abusers 3. In particular, methadone maintenance program has been shown to reduce HIV seroconversion rates 45, criminality, and injecting and sexual behaviors 614. Thailand has not adopted methadone maintenance as its policy for treating injecting drug users but is now considering it. The basis for deciding whether methadone maintenance should be implemented relies on evidences on its costs and effectiveness. Ideally, evidence for its efficacy and effectiveness should come from randomized controlled trials. However,
MATERIALS AND METHODS

Setting.

This study was conducted in Mae Chan District in Chiangrai, the northernmost province of Thailand which borders the Golden Triangle where opium is grown. Mae Chan District is about 30 km north of the central Chiangrai with a population of approximately 190,000 in 1997. The district is served with a 90-bed governmental hospital. The hospital treats the largest number of substance abusers in the province. Substance abusers seeking treatment in this hospital come from Mae Chan and other districts. An out-patient clinic for management of substance abuse is held once a week when new cases are enrolled. Old cases come to the hospital to take daily doses of methadone detoxification. The course for detoxification is 45 days starting with 30-40 mg of methadone and tapered to zero by the end of the course. At the beginning of each course of treatment, drug users are asked to be tested for HIV, regardless their previous HIV serostatus. Verbal informed consent is obtained. Pre- and post-test counseling is provided by a well-trained counselor. HIV infection in Thailand is exclusively due to HIV-1; no indigenous cases of HIV-2 infections have been documented.

The hospital maintains a registration logbook which contains identification numbers, names, demographics, drug use history, sexual behaviors and HIV serostatus. Data from a substance abuser are recorded in the logbook whenever he or she seeks for a new course of treatment. The logbook is securely kept and becomes accessible only to doctors and health professionals who are responsible for providing treatment and counseling to the patients.

Methods.

Nine years (1989-1997) of data (excluding the names) from the logbook were transcribed onto record forms and double-entered into two separate computer files, which were compared for typographic, transcription, and other errors using Epi Info version 5.01b. For each patient, the date of the first negative HIV antibody test (if any), the last negative test (if any), and the first positive test (if any), were determined. A retrospective cohort was constructed among drug users who were HIV-negative at the first course of treatment and were treated for more than one courses. HIV seroconverters were defined as drug users who had an initial negative HIV test and became HIV-positive at a subsequent course of treatment. For the drug users who remained repeatedly HIV-negative, the period of HIV-negative observation was determined based on the first and the last follow-ups. No efforts were made to assume their HIV serostatus beyond the last follow-up. The annual incidence is expressed as the number of HIV seroconverters per 100 person-years of HIV-negative observation. The probability of HIV seroconversion is assumed to follow a uniform distribution between the last negative and the first positive HIV tests. The 95% confidence interval (CI) for the incidence was calculated using a Poisson approximation method. Incidence rates and their associated 95%CI were calculated for each independent variable.

The HIV seroprevalence rate was calculated based on initial testing of the substance abusers during the periods of interest. Odds ratios (OR) and their associated 95% confidence interval (CI) were used to determine the strength of association between independent risk factors and HIV prevalence.

Serologic test methods.

During 1989 and 1994, blood was tested with an enzyme immunoassay (EIA) and, if positive, confirmed with an immunofluorescence assay (IFA) in the regional reference laboratory located in Chiangrai. Later (1995-1997), blood was tested with a particle-agglutination test called Serodia HIV® (Fujirebio Inc., Tokyo Japan). If the blood was found to be HIV-positive, it was retested with either one of two EIA test kits, i.e. Insti HIV1/HIV2® (Intracel Corporation, Cambridge Massachusetts) or TestPack HIV-1/HIV-2® (Abbot GmbH, Delkenheim Germany). Blood with repeat (twice) reactive results was considered HIV-positive.

RESULTS

There were 853 drug users seeking treatments at the Mae Chan Hospital during the 9-year period. Out of the 853 patients, 378 people (45.3%) were treated more than once. There were 2,094 courses of treatment for the 853 drug users (mean, 2.46; SD, 2.92; range 1-31; median, 1). Repeatedly-treated substance abusers, when compared to those who were treated only once, were more likely to be male, be Thai lowlanders, have formal education, use drug not for treating diseases or pains, use injection method, use drug more frequently and still use drugs while on treatment (table 1).

The 378 repeatedly-treated drug users provided 114,340 person-days of HIV-negative observation, during which 16 abusers (4.2%) seroconverted to HIV. This is equivalent to an HIV incidence rate of 5.11 per 100 person-years of observation.
Table 1. Characteristics of drug users who were treated once and twice or more

| characteristics                      | treated once | repeatedly treated | p-value |
|--------------------------------------|--------------|--------------------|---------|
| male                                 | 442/475 (93.1%) | 368/378 (97.4%)    | 0.004   |
| age ≤30 years                        | 231/475 (48.6%) | 171/378 (45.2%)    | 0.324   |
| ethnic minorities                    | 186/475 (39.2%) | 51/378 (13.5%)     | <0.001  |
| single                               | 202/475 (42.5%) | 165/378 (43.7%)    | 0.742   |
| no formal education                  | 170/475 (35.8%) | 49/378 (13.0%)     | <0.001  |
| unemployed                           | 79/475 (16.6%) | 50/378 (13.2%)     | 0.168   |
| using drugs for treating diseases or pain | 51/475 (10.7%) | 10/378 (2.6%)      | <0.001  |
| using drugs for >2 years            | 296/464 (63.8%) | 227/365 (62.2%)    | 0.635   |
| injecting drugs                      | 215/429 (50.1%) | 238/367 (64.8%)    | <0.001  |
| sharing syringes or needles (injectors only) | 82/214 (38.3%) | 93/238 (39.1%)     | 0.869   |
| using drugs more than 3 times per day | 176/475 (37.0%) | 193/378 (51.1%)    | <0.001  |
| still using drugs while on treatment | 193/475 (40.6%) | 197/378 (52.1%)    | <0.001  |
| having unprotected sex with other women (men only) | 316/442 (71.5%) | 274/368 (74.5%)    | 0.345   |

Figure 1. Prevalence and incidence of HIV among drug users in northern Thailand, 1989-1997.
Table 2. Characteristics of drug users who were HIV-positive and HIV-negative when first presenting to the hospital clinic (prevalence cases)

| characteristics                      | HIV-positive | HIV-negative | OR(95%CI)* |
|--------------------------------------|--------------|--------------|------------|
| sex                                  |              |              |            |
| -male                                | 267          | 543          | 1.43(0.68-3.09) |
| -female                              | 11           | 32           | 1          |
| age                                  |              |              |            |
| -≤30 years                           | 153          | 249          | 1.60(1.19-2.17) |
| ->30 years                           | 125          | 326          | 1          |
| ethnicity                            |              |              |            |
| -Thai lowlanders                     | 243          | 373          | 3.76(2.49-5.71) |
| -ethnic minorities                   | 35           | 202          | 1          |
| marital status                       |              |              |            |
| -married                             | 85           | 333          | 0.32(0.23-0.44) |
| -divorced/separated                  | 29           | 39           | 0.92(0.53-1.60) |
| -single                              | 164          | 203          | 1          |
| education                            |              |              |            |
| -having formal education             | 245          | 389          | 3.55(2.33-5.43) |
| -no formal education                 | 33           | 186          | 1          |
| occupation                           |              |              |            |
| -agriculture/labor                   | 189          | 380          | 0.90(0.59-1.37) |
| -merchandise                         | 35           | 66           | 0.96(0.53-1.71) |
| -other occupations                   | 8            | 46           | 0.31(0.12-0.77) |
| -unemployed                          | 46           | 83           | 1          |
| motivation to use drugs              |              |              |            |
| -under peer pressure                 | 250          | 464          | 4.16(1.85-10.98) |
| -for work-related, social and other problems and stresses | 21 | 57 | 2.84(1.04-8.06) |
| -for treating diseases or pain       | 7            | 54           | 1          |
| duration of drug use                 |              |              |            |
| ->2 years                            | 176          | 347          | 1.26(0.91-1.73) |
| ≤2 years                             | 88           | 218          | 1          |
| drug administration                  |              |              |            |
| -injecting                           | 225          | 228          | 7.07(4.79-10.48) |
| -smoking                             | 42           | 301          | 1          |
| sharing syringes or needles (injectors only) |          |              |            |
| -yes                                 | 113          | 62           | 2.73(1.80-4.13) |
| -no                                  | 111          | 166          | 1          |
| frequency of drug use                |              |              |            |
| ->3 times per day                    | 134          | 235          | 2.99(0.98-12.22) |
| -2-3 times per day                   | 139          | 319          | 2.29(0.75-9.32) |
| -once a day                          | 4            | 21           | 1          |
| still using drugs while on treatment |              |              |            |
| -yes                                 | 162          | 228          | 2.13(1.57-2.87) |
| -no                                  | 116          | 347          | 1          |
| having unprotected sex with other women (men only) |      |              |            |
| -yes                                 | 96           | 124          | 1.90(1.36-2.66) |
| -no                                  | 171          | 419          | 1          |

*OR = odds ratio, CI = confidence interval
## Table 3. HIV incidence by characteristics of drug users

| characteristics                      | observed rate | incidence/100 person-years of observation (95% confidence interval) |
|--------------------------------------|---------------|-------------------------------------------------------------------|
| sex                                  |               |                                                                  |
| -male                                | 16/107748     | 5.42(3.10-8.81)                                                   |
| -female                              | 0/6592        | 0(0-20.44)                                                       |
| age                                  |               |                                                                  |
| -≤30 years                           | 10/34165      | 10.69(4.80-23.79)                                                 |
| ->30 years                           | 6/80175       | 2.73(1.23-6.09)                                                   |
| ethnicity                            |               |                                                                  |
| -Thai lowlanders                     | 15/93966      | 5.82(0.82-41.43)                                                  |
| -ethnic minorities                   | 1/20374       | 1.79(0.25-12.73)                                                  |
| marital status                       |               |                                                                  |
| -married                             | 4/77712       | 1.88(1.04-3.40)                                                   |
| -divorced/separated                  | 1/5197        | 7.03(3.89-12.69)                                                  |
| -single                              | 11/31431      | 12.78(7.08-23.08)                                                 |
| education                            |               |                                                                  |
| -having formal education             | 16/98455      | 5.94(3.39-9.64)                                                   |
| -no formal education                 | 0/15885       | 0(0-8.48)                                                        |
| occupation                           |               |                                                                  |
| -agriculture/labor                   | 12/74209      | 5.91(3.05-10.31)                                                  |
| -merchandise                         | 2/14287       | 5.11(0.62-18.47)                                                  |
| -other occupations                   | 0/15368       | 0(0-8.77)                                                        |
| -unemployed                          | 2/10476       | 6.97(0.84-25.19)                                                  |
| motivation to use drugs              |               |                                                                  |
| -under peer pressure                 | 15/96442      | 5.68(3.18-9.37)                                                   |
| -for work-related, social problems   | 1/13188       | 2.77(0.07-15.43)                                                  |
| and other stresses                   |               |                                                                  |
| -for treating diseases or pain       | 0/4710        | 0(0-28.61)                                                       |
| duration of drug use                 |               |                                                                  |
| ->2 years                            | 11/71101      | 5.65(2.12-15.06)                                                  |
| ≤2 years                             | 4/40381       | 3.62(1.36-9.64)                                                   |
| drug administration                  |               |                                                                  |
| -injecting                           | 12/55127      | 7.95(2.98-21.18)                                                  |
| -smoking                             | 4/56897       | 2.56(0.96-6.85)                                                   |
| sharing syringes or needles (injectors only) |   |                                                                  |
| -yes                                 | 6/8963        | 24.45(10.54-52.24)                                                |
| -no                                  | 6/46164       | 4.74(2.05-10.14)                                                  |
| frequency of drug use                |               |                                                                  |
| ->3 times per day                    | 8/52499       | 5.56(1.39-22.29)                                                  |
| -2-3 times per day                   | 6/55746       | 3.93(0.98-15.72)                                                  |
| -once a day                          | 2/6095        | 11.98(2.99-49.92)                                                 |
| still using drugs while on treatment |               |                                                                  |
| -yes                                 | 10/54270      | 6.73(3.02-14.99)                                                  |
| -no                                  | 6/60070       | 3.65(1.64-8.12)                                                   |
| having unprotected sex with other women (men only) |   |                                                                  |
| -yes                                 | 5/21825       | 8.36(4.63-15.11)                                                  |
| -no                                  | 11/85923      | 4.68(2.59-8.45)                                                   |
reducing the risk of HIV infection among this group of people. The methadone detoxification program is not very effective in San Francisco during 1985-1990 19). It is indicative that current much higher than the rate of 1.9% per person-year as found in Thailand. ones reported from the Northern Drug Dependence Treatment Thailand.

ever relatively ignored, mode of HIV transmission in northern continued importance of use of illegal drugs as a major, how-
found to be more frequent in the same study. This indicates the use while on treatment are associated with higher HIV prevalence. Men who continue to have an unprotected sex with women (other than their wife) have a higher prevalence rate of HIV.

In table 3, HIV incidence rates are calculated for each independent risk factor. Males, the young, Thai lowlanders, singles, those with formal education, the unemployed and those in agricultural and labor sectors, those using drugs for non-medical reasons, long-term users, drug injectors, those who share needles or syringes, those still using drug while on treatment, and males who have unprotected sex with non-wife women tend to have higher incidence rates.

**DISCUSSION**

In northern Thailand, efforts in the past 10 years have been mainly focused on changing sexual behaviors of Thai men. Although significant changes in sexual behaviors among young men, especially increased use of condoms, have been documented in a report 17, use of illicit injection drugs was found to be more frequent in the same study. This indicates the continued importance of use of illegal drugs as a major, however relatively ignored, mode of HIV transmission in northern Thailand.

The incidence rate determined in this study is lower than the ones reported from the Northern Drug Dependence Treatment Center in Chiang Mai Thailand 18 and from Bangkok 19, but much higher than the rate of 1.9% per person-year as found in San Francisco during 1985-1990 18. It is indicative that current methadone detoxification program is not very effective in reducing the risk of HIV infection among this group of people. In addition, the fact that HIV seroprevalence rates did not coincide well with the incidence rates cautioned us against reliance on HIV prevalence as a way to measure program effectiveness. In fact, stable HIV prevalence has been shown to mask substantial incidence in a population with high turnover 1.

The overall prevalence rate of HIV infection among this group of population is composed of the prevalence rates among drug users who are treated only once and those who are repeatedly treated. The fact that repeatedly-treated drug users have a higher HIV prevalence rate than those who are treated once is readily explainable. Repeatedly-treated drug users tend to use drugs for a longer period and/or more frequently. These practices put them at a higher risk of acquiring new HIV infection and, also, being HIV-positive. Since estimation of HIV incidence rates is based on the repeatedly-treated drug users only, the incidence rates tend to be over-estimated. However, the estimates can serve as the higher end of the incidence rates which can be expected in this population. In addition, it is the repeatedly-treated drug users who are the high-risk group towards whom interventions should be directed.

The degrees of associations between risk factors and HIV prevalence as shown by odds ratios in table 2 are unadjusted and therefore subject to confounding. However, statistically-significant associations in the table are readily explainable and make biological senses. In addition, although the prevalence rates do not reflect well the underlying incidence rates, the patterns of associations between risk factors and the prevalence are consistent with those between the risk factors and the incidence, except for occupation. Therefore, no efforts were made to calculate adjusted odds ratios between the risk factors and HIV prevalence. With regard to drug use frequency, the fact that those who use drugs only once a day have the highest incidence rate is most likely due to the small denominator (i.e. few person-days of seronegative observation).

In this study, HIV incidence rates remain relatively stable over the study period while the prevalence rates show a decreasing trend. If HIV prevalence rates are used to monitor and evaluate effectiveness of an intervention program without knowledge of their prior relationship with the incidence rates, mistaken conclusions can be made regarding the program effectiveness. Therefore, understanding of the baseline trend of HIV incidence is essential to public health professionals who will implement and evaluate an intervention program. In addition, factors found to be associated with high rates of HIV incidence or prevalence can still be used to identify high-risk groups upon whom the intervention should be focused.

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