



# Diverse HIV epidemics among people who inject drugs in Thailand: Evidence from respondent-driven sampling surveys in Bangkok and Chiang Mai<sup>☆</sup>

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## ABSTRACT

**Background:** Thailand's long-standing HIV sero-sentinel surveillance system for people who inject drugs (PWID) is confined to those in methadone-based drug treatment clinics and representative data are scarce, especially outside of Bangkok.

**Methods:** We conducted probability-based respondent-driven sampling (RDS) surveys in Bangkok ( $n = 738$ ) and Chiang Mai ( $n = 309$ ) to increase understanding of local HIV epidemics and to better inform the planning of evidence-based interventions.

**Results:** PWID had different epidemiological profiles in these two cities. Overall HIV prevalence was higher in Bangkok (23.6% vs. 10.9%,  $p < 0.001$ ) but PWID in Bangkok are older and appear to have long-standing HIV infections. In Chiang Mai, HIV infections appear to be more recently acquired and PWID were younger and had higher levels of recent injecting and sexual risk behaviors with lower levels of intervention exposure. Methamphetamine was the predominant drug injected in both sites and polydrug use was common although levels and patterns of the specific drugs injected varied significantly between the sites. In multivariate analysis, recent midazolam injection was significantly associated with HIV infection in Chiang Mai (adjusted odds ratio = 8.1; 95% confidence interval: 1.2–54.5) whereas in Bangkok HIV status was not associated with recent risk behaviors as infections had likely been acquired in the past.

**Conclusion:** PWID epidemics in Thailand are heterogeneous and driven by local factors. There is a need to customize intervention strategies for PWID in different settings and to integrate population-based survey methods such as RDS into routine surveillance to monitor the national response.

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## 1. Introduction

Since the late 1980s, people who inject drugs (PWID) have been tracked as a key population in annual national HIV sentinel surveillance prevalence surveys conducted by the Thailand Ministry of

Public Health (MOPH). These surveys have shown that HIV sero-prevalence remained high at 30–50% over the last two decades (Brown et al., 1994; Thai National AIDS Committee, 2014). However, participants in these surveys have been recruited exclusively from drug treatment centers where the main service is methadone treatment for opiate users.

Studies among PWID in Thailand have been conducted mainly in Bangkok and have typically recruited participants enrolled in clinical trials (Martin et al., 2010; Pitisuttithum et al., 2006; van Griensven et al., 2005; Vanichseni et al., 2001) or from studies that used convenience-based sampling methods (Fairbairn et al., 2009; Hayashi et al., 2011; Kerr et al., 2009, 2010; Werb et al., 2009). Few community-based epidemiological studies have used methods appropriate to obtain data on representative samples

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of PWID such as respondent-driven sampling (RDS; Heckathorn, 1997, 2002; Johnston et al., 2010; Magnani et al., 2005). This situation exists despite the international recommendation to routinely implement such surveys among PWID populations (World Health Organization, 2012). An RDS survey was conducted in Bangkok in 2003–2004 but did not measure HIV seroprevalence and was carried out during an anti-drug campaign, commonly referred to as the “war on drugs”, that likely resulted in under-recruitment of out-of-treatment PWID (Wattana et al., 2007).

In Thailand, there has been a shift in the observed pattern of injection drug use away from heroin, which was the predominant drug during the 1980–1990s (Vanichseni et al., 2001; Weniger et al., 1991), to methamphetamine and midazolam (a short-acting benzodiazepine; Hayashi et al., 2011; Martin et al., 2010; van Griensven et al., 2005; Vongchak et al., 2005; Werb et al., 2009). The “war on drugs” in Thailand was launched in 2003 and the resulting intensified drug law enforcement, the declining demand and increased price of heroin all likely contributed to this trend (van Griensven et al., 2005; Vongchak et al., 2005). The shift away from heroin use over time has compromised the usefulness of surveillance data collected from methadone treatment clinics. For example, there is a lack of systematic data from both methamphetamine and midazolam injectors despite increasing use of these drugs and the fact that both drugs are associated with increased HIV risk behavior (Fairbairn et al., 2007; Martin et al., 2010; van Griensven et al., 2005).

Outside Bangkok, epidemiologic data on PWID are even more limited. This is of concern because the characteristics and dynamics of HIV epidemics among PWID are often localized and heterogeneous (Mathers et al., 2008; Sharma et al., 2009). Chiang Mai is a major northern city with documented high HIV prevalence among in-treatment PWID (Thailand Ministry of Health, 2009). The city is located near the ‘Golden Triangle’, a major source of opium production in the past, and more recently an entry route for both heroin and methamphetamine from bordering countries. In the late 1990s, the pattern of drug use in Chiang Mai, and Northern Thailand more broadly, has shifted from opiates to methamphetamines (Razak et al., 2003). Early after its introduction methamphetamine was typically smoked, taken orally or inhaled (UNODC, 2012), but there is evidence that injecting is increasing (McKetin et al., 2008).

We conducted community-based RDS surveys in Bangkok and Chiang Mai to help fill gaps in the understanding of local HIV epidemics among PWID and to inform the planning of evidence-based prevention, treatment, and care interventions and a more robust national surveillance system.

## 2. Methods

### 2.1. Survey design

RDS is a type of chain-referral sampling designed to sample hard-to-reach populations not typically reached through venue-based sampling methods (Heckathorn, 1997, 2002). RDS uses a dual system of structured compensation and quota limits on each individual’s ability to recruit members of their social network to reduce biases associated with other chain-referral methods. An initially selected group of participants (“seeds”) are purposively recruited who in turn recruit and refer their peers, continuing in multiple ‘waves’ of recruitment. At both locations in this study, seeds were selected by study investigators and clinic staff, with careful attention to diversities such as sex, type of drug use, and age.

### 2.2. RDS sites

In Bangkok, we used the office of a non-governmental organization, O-zone, as the site where we implemented RDS. O-zone has extensive experience working with the drug user population in Bangkok, including conducting outreach, education, and prevention with drug users. In Chiang Mai, the survey site was an office of the Research Institute for Health Sciences (RIHES) which was used for a concurrent intervention trial with PWID. Both sites were in accessible neighborhoods that include private rooms for interviewing, counseling and specimen collection.

### 2.3. Inclusion criteria

Eligible PWID were 18 years old or older who injected illicit drugs in the last six months and were able and agreed to provide informed consent. Recruited participants in Bangkok and Chiang Mai must have been living or working in the respective cities at the time of the survey and in possession of a valid referral coupon.

### 2.4. Survey procedures

Cross-sectional RDS surveys were conducted in Bangkok and Chiang Mai during March to October, 2009. Eligibility was assessed by trained survey staff in the non-governmental survey sites (see Section 2.3) and participants were asked to show injection marks and were administered a list of screening questions to confirm that they met the PWID inclusion criteria. Consenting participants completed a survey questionnaire administered by interviewers, who were trained to make participants feel comfortable during the interview process and elicit and record accurate information, and resulting data were entered into handheld personal digital assistants (PDAs). Participants also provided blood specimens for on-site rapid HIV testing (Determine HIV-1/2 Abbott Japan Ltd, Tokyo, Japan). Two confirmatory tests were conducted for those screening HIV-positive according to the MOPH national laboratory testing guidelines (Thailand Ministry of Public Health, 2011). HIV-positive participants were referred for care at local public facilities and CD4 count testing was provided at no cost. Participants were given not more than three coupons to recruit their peers. They received compensation of 400 Thai Baht (USD 11.5) for their time in completing the questionnaire and serological specimen collection and 80 Thai Baht (USD 2.3) for each recruited peer up to a maximum of 240 Thai Baht (USD 6.9) for three peers.

### 2.5. Data management and analysis

Questionnaire data from the handheld PDAs was synced to a Microsoft Access database and linked and merged with laboratory data using a confidential 17-digit coupon ID number. Respondent-Driven Sampling Analysis Tool (RDSAT) Version 6.0.1 (Cornell University, NY, USA) was used to generate univariate estimates of key variables that were weighted by network size and recruitment patterns. A design effect of 2.0 was used in RDSAT to account for potential clustering among recruits (Volz et al., 2009). RDSAT-generated weights data were exported to STATA 11.0 (College Station, Texas, USA) for bivariate analysis of variables (i.e., sociodemographics, injecting and sexual risk behaviors, exposure to HIV interventions, and HIV infection status) comparing participants in Bangkok with those in Chiang Mai. The Marascuilo procedure was used to calculate *p*-values for inter-city comparison estimates using standard errors adjusted with RDSAT (Marascuilo, 1966). Characteristics that could not be assessed by RDSAT were tested crudely using the Pearson chi-square test or Fisher Exact test as appropriate. In addition, bivariate analyses were conducted to examine factors associated with HIV infection in both cities. Probabilities were calculated by Z tests and adjusted odds ratios (AORs) and 95% confidence intervals (95% CIs) were generated. All statistical testing was two-tailed and a *p*-value <0.05 was considered statistically significant. Weighted data in STATA software were also used to conduct multiple logistic regression modeling to identify factors associated with HIV prevalence in both Bangkok and Chiang Mai. Only variables that were associated at a level of  $p \leq 0.10$  in bivariate analysis were entered into the multivariate models to determine factors that were independently associated with HIV infection at  $p < 0.05$ .

### 2.6. Ethical considerations

No personal identifying data were collected as part of this study. All records and specimens were labeled using the coupon ID number. The survey was approved by the Ethical Review Committee, Thailand MOPH, and the Institutional Review Board, Centers for Disease Control and Prevention, Atlanta, USA.

## 3. Results

### 3.1. RDS seeds and survey flow

In Bangkok, ten seeds were purposively selected to initiate peer recruitment into the survey, six were men, three were less than 30 years of age and five were currently in methadone treatment. Eight of the ten seeds successfully recruited peers and among these eight seeds the number of propagated recruitment waves ranged from 2 to 15 per seed. A total of 808 individuals including seeds were screened for eligibility. Of these, 738 (91.3%) PWID met the eligibility criteria and agreed to participate in the survey.

Of the eight seeds selected in Chiang Mai, six were men, three were less than 30 years of age and three were undergoing treatment at a methadone treatment clinic. All eight seeds successfully

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