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HHS Public Access

Author manuscript

J Subst Abuse Treat. Author manuscript; available in PMC 2022 July 01.

Published in final edited form as:

J Subst Abuse Treat. 2021 July ; 126: 108320. doi:10.1016/j.jsat.2021.108320.

The methamphetamine epidemic among persons who inject heroin in Hai Phong, Vietnam

Don C Des Jarlais[1], **Jonathan Feelemyer**[1], **Kamyar Arasteh**[1], **Duong Thi Huong**[2], **Khuat Thi Hai Oanh**[3], **Pham Minh Khue**[2], **Hoang Thi Giang**[2], **Nham Thi Tuyet Thanh**[3], **Jean Pierre Moles**[4], **Vu Hai Vinh**[5], **Roselyne Vallo**[4], **Catherine Quillet**[4], **Delphine Rapoud**[4], **Laurent Michel**[6], **Didier Laureillard**[4,8], **Nicolas Nagot**[4], **DRIVE Study Team**

[1]New York University College of Global Public Health, New York, NY, USA

[2]Haiphong University of Medicine and Pharmacy, Haiphong, Vietnam

[3]Supporting Community Development Initiatives, Hanoi, Vietnam

[4]Pathogenesis and control of chronic infections, Inserm, Etablissement Français du Sang, University of Montpellier, Montpellier, France

[5]Dept of Infectious and tropical diseases, Viet Tiep Hospital, Haiphong, Vietnam

[6]Pierre Nicole Center, French Red Cross, CESP/Inserrm 1018, Paris, France

[8]Infectious Diseases Department, Caremeau University Hospital, Nîmes, France

Abstract

Aims: To describe the current methamphetamine (MA) use epidemic among persons who inject heroin (PWID) in Hai Phong, Vietnam, and consider possibilities for mitigating adverse effects of methamphetamine use.

Methods: This study conducted surveys of PWID in 2016, 2017, and 2018 (N = 1383, 1451, and 1445, respectively). Trained interviewers administered structured interviews covering drug use histories, current drug use, and related risk behaviors. The study used urinalysis to confirm current drug use, and conducted HIV and HCV testing.

Results: Participants were predominantly male (95%), mean age of 40, and all reported injecting heroin. Respondents' reports of initiating MA use was rare up through early 2000s but increased exponentially through the mid-2010s. MA use was predominantly "smoking," heating the drug

Corresponding Author: Don Des Jarlais, NYU College of Global Public Health, 665 Broadway Suite 800, New York NY 10013, 212-992-3795, Don.desjarlais@nyu.edu.

Author contributions

DDJ is the principal investigator for the DRIVE project. DDJ/J.F. proposed the original research for this study; J.F. and K.A. performed data analysis and interpretation; R.V., D.T.T., K.T.H.O., P.M.K., H.T.G., N.T.T.T., C.Q., D.R., L.M., V.H.V., D.L., N.N., and DDJ provided guidance and assistance related to data collection, general program oversight, and review of the manuscript; J.P.M. was responsible for laboratory data and general oversight of laboratory procedures; all co-authors reviewed the final manuscript for approval prior to submission to the journal.

Conflict of interest declaration: none

and inhaling the vapor using a pipe; injecting MA was rare. Current (past 30 day) MA use appears to have plateaued in 2016–2018 with 53–58% of participants reporting no use in the last 30 days, 37–41% reporting low to moderate use (1 to 19 days in last 30 days), and 5–7% reporting very frequent use (20 or more days in last 30 days). This plateau reflects a rough balance between new users and individuals ceasing use.

Conclusions: MA use has become a substantial public health problem among PWID in Hai Phong. Initiation into MA use rose exponentially from 2005 to about 2015. Use of MA will likely continue for a substantial number of PWID. Currently, no medication is approved for treating MA disorders in Vietnam. Current psychosocial treatment requires highly trained counselors and months of treatment, so that psychosocial treatment for all PWID with MA disorders is likely beyond the resources available in a middle-income country such as Vietnam. Harm reduction programs implemented by community-based organization staff may provide a way to rapidly address aspects of the current MA epidemic. Such programs could emphasize social support for reducing use where possible and for avoiding escalation of use among persons continuing to use.

Keywords

Methamphetamine; Hai Phong; Vietnam; Viet Nam; Persons who inject drugs; Heroin; Mental health

1. Background

Large increases in the use of stimulant drugs by opioid users have followed opioid epidemics in many different geographic and historical contexts. Examples include cocaine use among heroin users in the U.S. (Brecht, Huang, Evans, & Hser, 2008), methamphetamine use among heroin users in Thailand (Hayashi et al., 2011), amphetamine use among fentanyl users in Estonia (Uuskula, Jarlais, & Vorobjov, 2019), and, most recently, methamphetamine use among prescription opioid analgesics/heroin users in parts of the U.S. (Golden et al., 2019).

These transitions in patterns of drug use can occur for multiple reasons: the combinations of stimulants and opioids may intensify drug effects, stimulants may be taken to offset undesired sedative effects of opioids, stimulants may relieve some symptoms of opioid withdrawal, and cyclical patterns in the use of opioids and stimulants can occur (Al-Tayyib, Koester, Langegger, & Raville, 2017; Hser, Huang, Brecht, Li, & Evans, 2008; Roxburgh, Degenhardt, & Breen).

In this report, we examine the increased use of methamphetamine (MA) among persons who inject heroin (persons who inject drugs; PWID) in Hai Phong, Vietnam from the early 2000s to 2018.

Vietnam experienced a heroin injecting epidemic beginning in the 1970s, with a notable problem of heroin injection among a large number of U.S. military personnel (Stanton, 1976). Opium was grown and heroin was manufactured in the Golden Triangle and then transported by overland truck routes throughout Southeast Asia (Beyrer et al., 2000; G. Stimson, 1994; G. V. Stimson, Adelekan, & Rhodes, 1996). An HIV epidemic followed the

heroin epidemic in the early 2000s among persons who injected heroin. HIV prevalence reached very high levels among PWID in some Vietnamese provinces—more than 60% among PWID in Hai Phong in 2006 (Hoàng, 2007). Methadone maintenance, access to sterile syringes, and antiretroviral treatment for HIV seropositive persons have since been implemented, with reductions in HIV transmission in many provinces. HIV incidence among PWID in Hai Phong is now less than 1/100 person-years at risk (Des Jarlais et al., 2019).

Since the early 2010s, however, the use of MA (locally called “ice”) has been increasing, both among PWID and noninjection drug users (Giang, 2013). There have been comparable increases in use among other high-risk groups in Hai Phong, including men who have sex with men (MSM), commercial sex workers, and taxi and truck drivers (who often will use MA to stay alert during long work shifts) (United Nations Office on Drugs and Crime, 2012). The predominant form of MA use in Hai Phong is through smoking (heating the drug and inhaling the vapor); reports of injecting are extremely rare (less than 5% among PWID).

Researchers have conducted a number of studies of MA use among PWID in Hai Phong. In a 2014 respondent-driven sampling (RDS) survey (N = 603) of PWID who inject heroin in Hai Phong, 24% of the participants reported recent smoking of MA (Michel et al., 2017). Feelemyer et al. found associations between MA use and engaging in unsafe sex (Feelemyer et al., 2018) and between MA use and failure to attain HIV suppression among HIV seropositive PWID (Feelemyer et al., 2020).

In this paper, we examine the evolution of the MA epidemic among PWID in Hai Phong, from the early 2000s through 2018, identify risk factors for current MA use, and consider possibilities for increasing treatment for problematic MA use.

2. Material and methods

The research team included members of different community-based organizations (CBOs)—drug user peer support groups in Hai Phong that focus on particular drug using populations, such as Friendship Arms and Lighthouse CBOs for PWID, White Sands CBO for MSM, and Virgin Flowers CBO for female commercial sex workers (Des Jarlais et al., 2016). In total, more than 35 CBO members participated in the different aspects of the study. CBO staff participated in research decisions about how to implement respondent-driven and snowball sampling; they selected the seeds for RDS; participated in the development of the questionnaire; and provided expertise on collecting sensitive data, including conducting urinalyses, taking fingerprints, asking questions on sex work and male-with-male sex, and injecting risk behaviors. They also conducted the interview sections dealing with sensitive questions; provided advice on maintaining confidentiality; provided continuous information on developments within the drug using community, including police activities that would potentially interfere with the research; and provided contextual information about MA use in the city. Finally, the CBO members provided support and assistance to the participants in various aspects of the overall research project, including the cohort studies, by maintaining monthly contact and assistance in accessing methadone and ART treatment and adherence.

This is similar to CBO participation in other research studies in Vietnam (Le, Grau, Nguyen, Khuat, & Heimer, 2015).

2.1 Respondent-driven and snowball sampling surveys

We conducted three large community-based surveys among PWID in Hai Phong using a combination of RDS and snowball sampling in 2016, 2017, and 2018. The target number of participants for each survey was approximately1,500 (Des Jarlais, 2018). The eligibility criteria for participation in the surveys were: age 18 or older; recent injection drug use, validated through both urine testing for an injectable drug (heroin/morphine or methamphetamine) and presence of recent injection marks; residence in Hai Phong; and ability to provide informed consent. Study staff permitted participants to participate in multiple surveys but only once in each survey.

We began each of these surveys using standard RDS methods and 20 “seeds,” that CBO staff selected for diversity (age, gender, HIV status, with at least 2 seeds in each category) and having large social networks of PWID (Heckathorn, 1997; Heckathorn, Semaan, Broadhead, & Hughes, 2002). The study paid participants a modest honoraria for both their own time and effort in the study and for recruiting new participants. The study used an electronic fingerprint reader (9900C, Ronald Jack, Malaysia) to protect against participants’ participating multiple times in each survey and to link persons who participated in more than one survey.

Approximately five weeks into each of the surveys, recruitment of new participants slowed considerably, to the point where it became clear that continuing standard RDS methods would not permit us to reach our desired sample sizes. The CBO staff reported that participants were having considerable difficulty in recruiting new participants because of police surveillance of drug distribution hotspots; concerns over disclosing drug use and/or HIV status; travel difficulties; and competing demands on their time, such as employment. We, therefore, continued our basic RDS methods, but also added a “snowball” sampling (Kaplan, Korf, & Sterk, 1987) component to recruit new participants, in which participants were permitted to recruit up to 20 new participants. We continued distributing and tracking coupons within the combined RDS and snowball sampling.

This modified strategy—continuation of RDS plus addition of a snowball sampling component—did permit us to come close to our desired sample size of 1,500 participants in each of the surveys. As this change in our recruitment methods violated RDS assumptions, we did not use RDS weighting in our analyses. We did calculate RDS equilibria and homophilies for the combined RDS and snowball sampling, using standard RDS formulae (Heckathorn, 1997; Heckathorn et al., 2002). The study reached equilibria within 2 or 3 rounds and homophilies were close to 1 for all major study variables. (Data avalable upon request from first author.)

2.2 Data collection

Study staff conducted the research in two project-specific locations in Hai Phong that were easy to access for the PWID via motorway but did not have any identifying signage or

information visible from the outside. Participants would know the location of the study sites because this was printed on the RDS coupons.

When participants came to the study site, staff collected and recorded their RDS coupons, and used a fingerprint reader (model 9900, Ronald Jack, Malaysia) to determine if they had previously participated in that survey. Staff assigned each participants a study ID number. Study staff then obtained written informed consent. Research staff screened participants for eligibility, using urinalysis and visual inspection for marks of recent injecting. Participants next participated in a structured face-to-face interview covering history of and current drug use and practices, sexual behaviors, and health-seeking behaviors, administered by trained and experienced interviewers. Next, the study used Provincial AIDS Committee nurses for HIV/HCV counseling and to test, with a blood sample, for HIV and HCV, and for the CD4 count and viral load if the HIV test was positive.

The study coded all blood samples with a participant ID at the site of collection and transferred the samples every day to the Haiphong Provincial HIV/AIDS Center laboratory (the laboratory has Vietnamese national accreditations for HIV and HCV testing). Laboratory and quality control procedures followed the WHO Good Laboratory Practice guidelines. After completion of data collection procedures, the study paid participants an honoraria (150,000 Vietnamese dong, approximately $7.50) and gave them coupons for recruiting new participants. Participants returned to the research site approximately one week later to receive test results and any recruiting honoraria (50,000 Vietnamese dong, approximately $2.50) that they were owed.

Study staff provided all participants with post-test counseling (harm reduction for safer injection and safer sex) for HIV and HCV. The study also offered all HIV seropositive participants assistance in accessing antiretroviral therapy (ART), which is provided free in Vietnam.

The study tested urine samples for heroin/morphine, methamphetamine, and methadone using Drug-screen Multi 7A carte (Nal von Minden, Germany). The study tested blood samples for HIV and HCV. HIV serology followed national guidelines including an initial rapid test using SD BIOLINE HIV 1/2 3.0 (Standard Diagnostic Inc., South Korea), with confirmation using two other rapid tests (Alere Determine HIV 1/2, Abbott Alere Medical Co., Japan, and VIKIA®HIV1/2, Biomerieux, France). The study conducted CD4 counts using the BD FACS Count system (BD Biosciences, San José, USA). HCV serology relied on a rapid test SD BIOLINE HCV (SD standard Diagnostic Inc., South Korea).

Across the 3 surveys, we had 8% to 10% of persons who came to the research sites and asked to participate in the study but did not meet our eligibility requirements. Almost all of these failed the requirement of visual evidence of recent injection. As these persons were not eligible to participate in the study, we did not collect questionnaire information from them. We did not have any eligible subjects refuse to participate in the study or refuse to provide a blood sample. We expected this, because with peer recruiting all potential subjects would have been informed of the study procedures prior to coming to the research site. Note also that the recruiters did not receive their recruiting honoraria if the potential subject did not

agree to participate in the study, so that the recruiters had a strong motivation to fully inform potential new subjects about the study procedures and make certain that the potential new participants were willing to participate in the study.

We had both urinalysis and self-report data on drug use. As social desirability may lead research participants to under-report drug use, we used the measure that indicated the highest rate of use for each drug. For heroin, all participants tested positive for heroin/morphine and reported injecting heroin. Social desirability appeared to be of particular concern regarding methadone as 23% of participants who tested positive for methadone in the urinalysis denied being on methadone treatment or using diverted methadone in the later interview. We, therefore, used the urinalysis data for our measure of methadone use. In contrast, more participants reported using MA than tested positive for MA. This is consistent with the self-reports of infrequent MA use, which would not have been detected by urinalysis. We, therefore, used the self-report data for measuring MA use.

We inquired about date of first MA use, MA use in the previous 6 months, and previous 30 days. Current MA use was trichotomized into self-reported methamphetamine smoking: 1) none in last 30 days, 2) 1–19 days in last 30 days, and 3) 20 or more days in last 30 days based on previous studies examining methamphetamine use (McKetin, Hickey, Devlin, & Lawrence, 2010). We examined stability and change in MA across repeat participation in the different surveys using this trichotomy. We also dichotomized past 30-day MA use into any versus none for analyses of risk factors for MA use.

2.3 Statistical analyses

This study used means with standard deviations and proportions with 95% confidence intervals to describe the participants within the surveys. The study used chi-squared test to test the differences in proportions among nonrepeat participants across surveys. To compare proportions of repeat participants across surveys, we used McNemar's chi-square test for matched case-control data. We used logistic regression to identify associations among demographic characteristics, other drug use behaviors, health issues (including HIV serostatus and HIV disease progression) and MA use. (See Feelemyer et al. [2018] for associations of MA use to sexual risk behaviors and Feelemyer et al. [2020] for MA use and lack of HIV viral suppression.) We examined potential relationships with MA use dichotomized as no use versus any use.

In RDS theory, samples with sufficiently long recruitment chains to achieve equilibrium are independent of initial seeds (Heckathorn, 2002) and have asymptotically unbiased estimators (Salganik, 2004). All surveys reached RDS equilibrium on our major variables within three waves, so we treated the surveys as independent convenience samples with repeated measures and replacement.

The study used STATA 15 for analysis and generation of figures (STATA Corp, 2018).

3. Results

3.1 Demographic and drug use characteristics

The study recruited 1,383, 1,451, and 1,445 participants for the surveys conducted in 2016, 2017 and 2018, respectively. Across the three surveys, the study recruited 80.4% of participants under RDS methods and 19.6% under the additional snowball sampling method. Comparison of participants recruited through standard RDS methods to participants recruited through snowball sampling did not show significant differences on any of the major study variables (demographic characteristics, drug use, and HIV and HCV prevalence). RDS diagnostics (reaching equilibrium on important variables, low homophilies), were all within acceptable ranges. (Data not shown, available from the first author). Table 1 presents the demographic characteristics and drug use behaviors of the participants in the three surveys. Participants were predominantly male, had a mean age near 40, approximately one-third were single, one-third married, and one-quarter divorced, 26% to 30% were HIV seropositive, and approximately 67% were HCV seropositive.

There was a statistically significant increase in positive urinalyses for methadone between 2017 and 2018, and significant reductions in reported daily heroin injection between 2016 and 2017, and between 2017 and 2018.

3.2 Methamphetamine use: The epidemic

All participants who reported MA use reported smoking the drug, and injecting MA was uncommon, with less than 5% reporting injecting MA in each of the surveys.

There were a total of 2,377 different participants in the three surveys. Figure 1 shows the self-reported year of first MA use among the individual participants in the three surveys up through 2015 (the year prior to the first of these surveys). There was a modest number reporting first MA use up to 2005, followed by rapid acceleration in the number of first MA users from 2012 up to 2015. Logarithmic graphing is often used for phenomena that exhibit exponential rates of increase, such as the spread of a readily transmissible infectious disease. Figure 2 shows the number of PWID reporting first use of MA on a logarithmic (base e) scale. With occasional variations (perhaps due to rounding errors when participants recalled how long ago they first used MA), the graph approaches the straight line that would occur with exponential increase during the period of initial increase. Note that an increase of 2 on this natural logarithmic scale represents an increase by a factor $e^2 = 7.4$ in the number of persons beginning to use MA. There is a slight indication of a decrease in the rate of new MA use around 2015.

Table 2 presents prevalence of self-reported past 30 days MA use among the participants in the three surveys. MA use remained relatively stable with 53–58% of participants reporting no use in the past 30 days, 37–41% reporting low to moderate use (on 1 to 19 days out of the past 30 days), and 5–7% reporting very frequent use (20 or more days out of the past 30 days). There were no significant differences in MA use across the three surveys.

Using crosstabulations and univariate logistic models, we assessed relationships between demographic and drug use variables in Table 1 for significant associations with any self-

reported MA use in the previous 30 days in each of the three surveys. We also included a methodological variable in these analyses—whether the participants were recruited through RDS or snowball methods. As shown in Table 3, the only variables significantly associated with MA use were female gender, younger age, and being HIV seronegative, and these variables were significant in all three surveys. The ORs for the associations between each of these factors and MA were very similar across the three surveys.

3.3 Short-term (one year) stabilities and fluctuations in MA use

As noted in the Methods, the study permitted individuals to participate in multiple surveys, and we used fingerprint readers to link participants across the surveys.

Table 4 presents stability and change in self-reported MA use in the past 30 days among repeat participants from 2016 and 2017 (N=457), and among repeat participants in 2017 and 2018 (N =500). There was considerable stability but also meaningful fluctuation among the three MA use frequency categories. In both the 2016–2017 and the 2017–2018 repeat participant comparisons, approximately 64% reported using at the same frequencies, approximately 14% reported increased frequencies of use, and approximately 22% reported decreased frequencies of use. The changes in frequency of use were almost always between adjacent categories, with only a very small percentage of participants (less than 3%) reporting a two-level frequency category change.

There were no significant differences between any versus no MA use in the prior 30 days in repeat participants and the total survey participants in the 2017 and 2018 surveys. Approximately 45% reported any MA use (see Table 1).

3.4 Longer-term temporal trends

We used data from the 2018 survey participants to examine the extent to which different longer-term temporal patters of self-reported MA use had developed in the PWID population. The study used date of first MA use and past 30-day MA use to identify these four patterns:

1. “Never” users, who reported never having used MA: 436 (30%);
2. “Continuing” users, whose first use was at least two years prior to the 2018 interview and were using in the 30 days prior the interview: 400 (28%);
3. “Long-term former” users, whose first use was at least two years prior to 2018 interview and did not use in the 30 days prior to 2018 interview: 220 (15%); and
4. “New users,” person whose first use was within two years of 2018 interview: 399 (27%). Of these, 228 (16% of total participants) had used in the 30 days prior to the 2018 interview, and 161 (11% of total) had not used in the 30 days prior to the 2018 interview.

The three groups of never, continuing, and new users were of approximately equal size, with the long-term former user’s group somewhat smaller. Note, however, that the total participants who had ever used MA and did not use in the 30 days prior to the interview—long-term former users (15%) and new who were not using in the prior 30 days (11%)—

would equal 26% of the total participants in the 2018 survey and would be larger than the "new users" who did use MA in the 30 days prior to the survey. The plateau in current MA use is a result of the continuing users, new users who used in the prior 30 days, and former users who did not use in the prior 30 days.

4. Discussion

4.1 Epidemiology of use of a psychoactive substance within a susceptible population

As Figures 1 and 2 show, first MA use began to increase among our study participants beginning around 2005 with an exponential increase in the number of first users. These curves, along with the cessations of MA use (see Table 4 and "former users" noted above), are consistent with the increase from 24% **of** participants currently using MA in the 2014 Hai Phong study (Michel et al., 2017) to the 44% of respondents currently using MA in our 2016 survey.

4.2 Problematic use of MA

We did observe several aspects of problematic MA use. Although composing only 5% of the study population, female participants were significantly more likely to report MA use than male participants across the three surveys (ORs from 1.45 to 1.85). Many of the females did engage in commercial sex work, and the stresses of sex work may have led to the higher rate of MA use among these females.

MA use has been associated with failure to achieve viral suppression among HIV seropositive persons in multiple studies (Ellis et al., 2003; Massanella et al., 2015), and recent MA use (use in the last 30 days) is associated with failure to achieve viral suppression among our participants (AOR: 1.84, 95% CI: 1.06–3.17) (Feelemyer et al., 2020). We have also observed associations between MA use and sexual risk behaviors among participants, noting statistically significant associations between recent MA use and any unsafe sex (AOR 2.30, 95% CI: 1.20–4.42) and between recent MA us and unsafe sex with primary partners among sexually active HIV positive PWID (AOR 2.43, 95% CI: 1.15–5.10) (Feelemyer et al., 2018). Although HIV seropositive status was associated with a lower likelihood of MA use among our participants, more than 30% of our HIV seropositive participants reported MA use in each of the surveys, which is a cause for concern, given the relationships between MA and lack of viral suppression and MA use and unsafe sex among HIV seropositive participants.

4.3 "Non-negative" aspects of the MA epidemic to date

While current MA use clearly has not yet started to decline in Hai Phong, there are certain "non-negative" aspects of the epidemic that deserve comment. First, after at least fifteen years of growth in the number of PWID using MA, use of MA remains almost entirely through smoking, with less than 5% of MA users reporting any use through injecting, and all of those also reporting smoking the drug.

Second, the number of persons using at very high frequencies (20 or more days per month) was relatively modest (5% to 7% of the PWID population) in the three surveys and did not increase from 2016 to 2018.

Third, a substantial proportion of the PWID population, 26%, reported having used MA in the past but were not using in the 30 days prior to the 2018 survey.

4.4 Implications for treatment for problematic MA use

There are no medications approved as of this writing for the treatment of stimulant use disorders in Vietnam. The currently available abstinence-oriented psychosocial treatments have modest effect sizes (Shearer, 2007), typically require highly trained therapists, and typically require months of treatment. Thus, current psychosocial treatments for MA use disorders cannot likely be provided on a public health scale in resource limited places, such as Vietnam. HIV seropositive MA users already engaged in methadone treatment and who are not at viral suppression may be the highest priority for resource-intensive psychosocial treatments.

Nevertheless, peer involvement may serve to reduce harms associated with MA use. Many of the participants in our surveys reduced their MA use over time, and in the 2018 survey, 26% of participants had used MA in the past but were not currently using. Peer support groups to encourage PWID to reduce using MA were effective in another Southeast Asia study (Sherman et al., 2009). Our CBO peer support groups have also been effective in increasing uptake and adherence to ART among HIV seropositive PWID in Hai Phong (Des Jarlais et al., 2019). The peer support would need to be provided within a harm reduction framework, with accurate information about the effects of MA use, and social support for avoiding very frequent use, but without condemnation of individual MA users. Harm reduction counseling for MA users may encourage them to develop personal plans before using to use with reduced likelihood of harm and to moderate use so that it does not interfere with sexual functioning, or interfere with personal relationships or ability to perform work. Paranoia is a common symptom of MA use, and harm reduction counseling can be useful in reducing anxiety and consequences such as arrest, violence, or self-injury. Counseling can also be used to encourage maintaining hydration and proper nutrition, and obtaining sleep or rest. Treatment providers can provide pipes for smoking MA to avoid burned lips and possible transmission of hepatitis C virus, toothbrushes and toothpaste can be provided to reduce the likelihood of dental problems (Kingston Susan, 2004; Pinkham S, 2015).

Community-based contingency management (Petry, 2012; Rawson, McCann, Huber, & Shoptaw, 1999) implemented by CBO staff might also be useful in preventing progression to very frequent MA use. CBO staff could monitor use, provide appropriate rewards for reducing use and avoiding frequent use, and teach strategies for avoiding progression in MA use. The rewards would need to be relatively low cost and meaningful to the individuals but could include such things as cell phone minutes, personal care items, and gifts for spouses and children.

4.5 Continuation of MA use in Hai Phong

Predicting the future of an ongoing epidemic is always difficult. However, based on studies of previous MA epidemics in other areas (Colfax & Shoptaw, 2005; Lim, Cogger, Quinn, Hellard, & Dietze, 2015; Tanne, 2006; United Nations Office on Drugs and Crime, 2012), we would assume continued MA use in a substantial percentage of current MA users. Some individual users may already have developed stimulant use disorders and may have greater difficulties in ceasing MA use. Thus, there is likely to be a continuing need of health services for MA users in Hai Phong. Hopefully, CBO harm reduction services, as discussed above, will be able to limit the number of persons who develop MA use disorders.

4.6 Limitations

We should note several limitations of this study. First, while we designed the study to assess injecting related HIV transmission, we obtained data only from persons who were injecting drugs. Future research should examine MA use among persons not injecting drugs. Smoking MA may replace injecting heroin as the dominant form of drug use in Vietnam.

Second, our eligibility criteria included a positive urine test for an injectable drug and evidence of recent injection. Thus, we may have missed persons who injected only infrequently. However, because the primary purpose of the research was to study injecting-related HIV transmission, we had to include only persons for whom we could be certain that they were currently injecting and avoid enrolling persons who might not be currently injecting.

Third, our data on year of first MA use are necessarily retrospective from participants recruited in 2016–2018. There may have been PWID who began using MA in the late 1990s– early 2000s and who had ceased injecting drug use by 2016–2018, and thus were not eligible to participate in our surveys. Not capturing such subjects would have reduced the number of PWID reporting MA use in the late 1990s–early 2000s, but the close approximation of the growth of first MA use to a logarithmic curve (Figure 2) suggests that the number of very early users who we missed in our surveys was not large. Because MA use was based on self-report, we cannot rule out recall bias in reporting histories of MA use, particularly for those who are infrequent or not currently using MA.

Fourth, standard RDS methods did not produce our desired sample sizes, so we added snowball sampling recruitment procedures (allowing individual participants to recruit more than 3 new participants) and treated the samples as convenience samples rather than true RDS samples. There was, however, no difference in MA use between the RDS and the snowball recruited participants. Our large sample sizes also provide some basis for generalizing to the PWID population in the city as a whole.

5. Conclusion

The MA epidemic among persons who inject heroin in Hai Phong began in the late 1990s–early 2000s and exhibited an exponential increase in new MA users up to 2015. The epidemic appears to have plateaued, with no increase in current (past 30 days) MA use

between 2016 and 2018, and a substantial number of PWID ceasing MA use to balance out new MA users.

Only a modest percentage (5–7%) of PWID reported using at very high frequencies (20 or more days out of the previous month). However, problems persist, including failure to achieve viral suppression among HIV seropositive PWID on ART and evidence of increased sexual risk behaviors, particularly among HIV positive PWID who use MA. Vietnam lacks recourses to provide intensive psychosocial treatment for MA use disorders. Utilizing community-based organization staff to implement a harm reduction approach to MA use may offer an opportunity for Vietnam to address its current MA epidemic.

Acknowledgments

This work was supported by grants from NIDA (US) 1R01DA041978 and ANRS (France) 12353. The funding agencies had no role in designing the research, data analyses and preparation of the report.

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Highlights

1. In addition to heroin and HIV, Vietnam is now experiencing a methamphetamine (MA) epidemic.
2. Current use of MA among PWID in Haiphong, Vietnam has plateaued at a high level: 45% in 2016–2018.
3. Current psychosocial treatments for MA use have modest effect sizes and are resource intensive.
4. It is unlikely that current treatments can be provided on a public health scale in Viet Nam.
5. There is a great need to develop community-based peer harm reduction services to address MA.

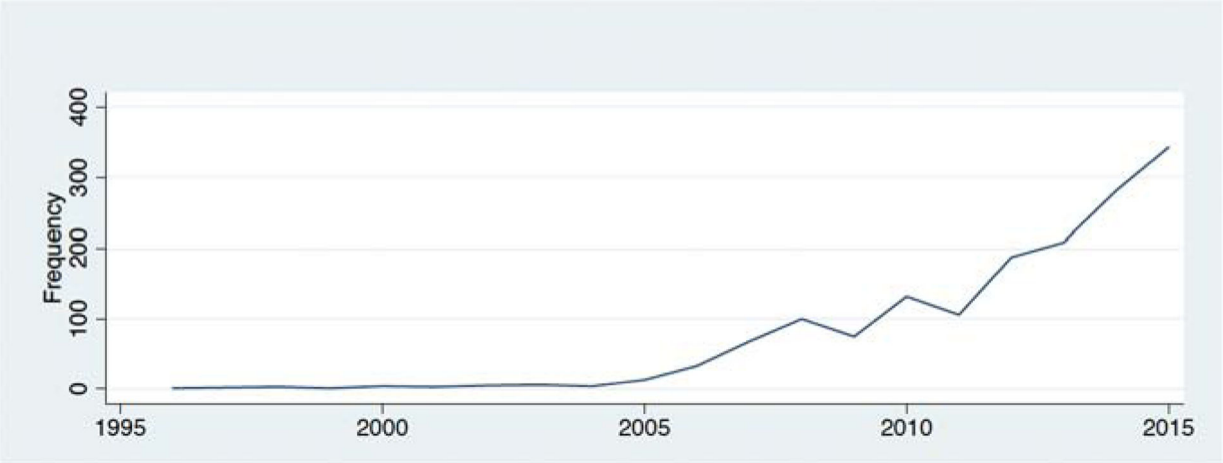

Figure 1:
Number of PWID beginning methamphetamine use by calendar year in Hai Phong Vietnam

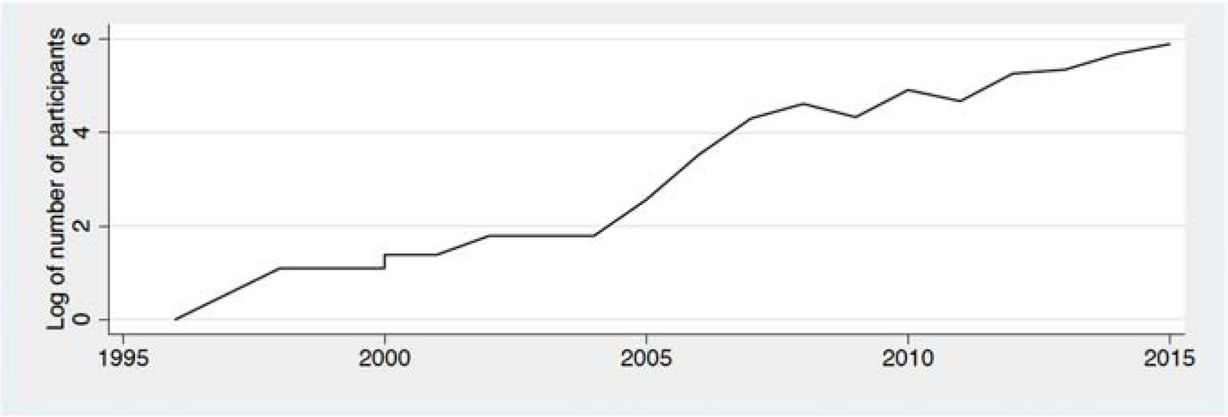

Figure 2:
Number of PWID beginning methamphetamine use by calendar year in Hai Phong, Vietnam, logarithmic scale

Table 1:

Demographics and drug use characteristics among PWID by survey entry into DRIVE Study among PWID in Hai Phong, Vietnam.

	2016	2017	2018
	N	N	N
Total	1383	1451	1445
Age (Mean, SD)	39.9 (9.0)	40.2 (9.0)	41.5 (8.8)
	%	%	%
Gender			
Female	6.0	4.5	5.3
Male	93.6	95.2	94.4
Marital status			
Single	34.9	32.8	27.4
Legally married	33.3	35.6	39.4
Living as couple	3.3	4.7	4.8
Divorced	27.0	25.3	26.3
Widowed	1.2	1.7	2.1
Daily heroin injection *	80.0	77.7	70.3
Urine Methadone *	42.0	56.7	63.9
Urine Methamphetamine	37.9	34.5	33.4
Methamphetamine (last 30 days smoked)	46.6	41.9	43.7
HCV Positive	71.2	67.1	68.2
HIV Positive	29.7	25.8	26.5

* significant difference $p < .001$ for 2016 to 2018, by McNemar's test for repeat participants and chi square tests for non-repeating participants.

Table 2:

Levels of smoking methamphetamine across three RDSS surveys (2016, 2017, 2018) among PWID in Hai Phong, Vietnam.

	2016		2017		2018	
Methamphetamine (smoked last 30 days)	**N**	**%**	**N**	**%**	**N**	**%**
0 days	738	53.4	843	58.1	813	56.3
1–19 days	566	40.9	535	36.9	534	37.0
20 or more days	79	5.7	73	5.0	98	6.8
Total	1383	100.0	1451	100.0	1445	100.0

Table 3:

Factors associated with methamphetamine use in three surveys among PWID in Hai Phong, Vietnam.

	2016		2017		2018	
Gender	**Total N**	**% MA**	**Total N**	**% MA**	**Total N**	**% MA**
Female	83	57.8	66	56.1	76	57.9
Male	1294	45.9	1381	41.3	1364	43.0
OR (ref:Male)	1.46 (0.94–2.26)		1.83 (1.13–2.97)		1.84 (1.17–2.90)	
HIV serostatus						
Negative	968	50.5	1061	45.1	1048	48.5
Positive	411	37.2	375	32.3	383	31.1
OR (ref: HIV+)	1.72 (1.36–2.18)		1.72 (1.34–2.21)		2.09 (1.63–2.68)	
Age *						
18–19	0	0	2	100.0	1	0.0
20–24	39	66.7	50	54.0	13	53.8
25–29	137	54.7	101	41.6	91	47.3
30–34	238	51.3	249	45.8	212	45.8
35–39	286	42.3	312	44.9	319	41.7
40–44	278	46.4	285	37.9	307	41.7
45–49	204	42.6	228	35.5	241	42.3
50–54	109	45.9	125	41.6	128	44.5
55–59	62	32.3	69	42.0	84	48.8
60+	29	51.7	30	43.3	48	50.0

* $p<0.01$ by trend test

Table 4:

Stabilities and changes in methamphetamine smoking among repeat participants* in three surveys among PWID in Hai Phong, Vietnam.

	Methamphetamine days (at 2017)		
	0	**1–19**	**20 or more**
Methamphetamine days (at 2016)	**%**	**%**	**%**
0	**40.3**	12.9	1.1
1–19	18.2	**19.9**	2.0
20 or more	1.1	2.6	**2.0**
	Methamphetamine days (at 2018)		
Methamphetamine days (at 2017)	**%**	**%**	**%**
0	**42.4**	14.8	0.4
1–19	12.2	**22.4**	3.6
20 or more	0.4	2.4	**1.4**

The top left to bottom right diagonals indicate participants who did not change their category of MA use across two surveys. Percentages above the diagonal represent participants who increased their MA use, percentages below the diagonals represent participants who decreased their MA use.

* N = 457 repeat participants in 2016 and 2017 surveys, 500 repeat participants in 2017 and 2018 surveys