Amphetamine-Type Stimulants (ATS) Use and Risks for HIV Infection and Transmission among Injecting Drug Users in A China-Myanmar Border Region

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Abstract

Background

Amphetamine-type stimulants (ATS) have become one of the most widely used illicit substances in the world and continues to pose significant health and social challenges. However, despite its increasing use and incidence of harms, especially the transmission of HIV due to injecting drug use and associated high-risk sexual behaviours, research about ATS use among current injection drug users (IDUs) is still lacking in China.

In China, the first HIV epidemic occurred in Ruili, a city located in the border region between China and Myanmar, with the discovery of 146 HIV-infected IDUs in 1989. Over the past 25 years, Ruili's geographic location and expansive economic activities ranging from jade to illicit drugs has caused severe public health problems. This area has become one of the most severely affected locales in China with a reported cumulative total of 4,554 HIV/AIDS cases till 2009, and 41.8% transmitted by

injection drug use. Nowadays, as Myanmar has become one of the world‘s largest producers of methamphetamines and primary source of methamphetamine pills in the Asia-Pacific region, Ruili is also facing a critical situation since it is a major transit point for drug trafficking from Myanmar to China. This study aimed to identify the prevalence, to describe the patterns, to examine the correlates and to explore the reasons and context of ATS use among current IDUs in Ruilli city. It is hoped that the results will provide more evidence for health officers and policy makers to better construct target prevention and interventions.

Methodology

A mixed method research using both quantitative and qualitative approaches was carried out in Ruili city in 2012. A total of 370 IDUs who were Chinese, had injected drugs within the past six months and aged at least 18 years were recruited in a cross-sectional survey using respondent-driven sampling (RDS). All participants underwent interviews and serological testing for HIV, HBV, HCV and syphilis. A total of 20 in-depth interviews with current IDUs were conducted to explore the reasons and context of ATS use. Univariate and multivariate logistic regression were performed to identify factors associated with current methamphetamine use and HIV/HCV infections using survey design-based methods in the R language and environment. The multiplier method was used to get the size of the current IDU population via combining available service data and findings from the survey.

Type-recorded data were fully transcribed and the themes with respect to particular topics were identified using content analysis.

Results

Methamphetamine pill was the most commonly used ATS and smoking/snorting were the only routes of administration reported by our participants. Among 326 (84.2%) participants who reported a lifetime history of ATS use, all of them used methamphetamine pill and 293 (75.2%) had used it within the previous 6 months. Among 293 current methamphetamine users, 18.1% ever purchased methamphetamine from Myanmar while 8.9% ever used it there during the past 6 months. IDUs who had cross-border activities, including purchasing drugs and visiting family/friends, doing business or odd jobs in Myanmar, were more likely to use methamphetamine in the past six months. Other factors independently associated with current methamphetamine use included being younger, being syphilis positive, having used previously self-used needles and syringes and recently received prevention services. Not only the IDUs but also the public community perceived that methamphetamine use was less harmful and more acceptable than using heroin. There were no significant associations found between current methamphetamine use with sexual risk behaviours and with HIV infection status, however methamphetamine was used to increase libido and facilitate sexual encounters and having sexual intercourse while being high on drugs was common practice. This highlights the role of

methamphetamine in sexual contexts which increases the risk of sexually transmitted diseases among this primary heroin injecting population.

Moderate levels of HIV (18.3%) and HCV (41.5%) infections were found among current IDUs. In addition, the growing population size of current IDUs (estimated number: 2714; 95% CI: 1617-5846) and low coverage of harm reduction services (current utilization of needle-syringe exchange programme and methadone maintenance treatment was reported by 28.0% and 3.5% of participants, respectively) are a growing concern.

Conclusions

Methamphetamine has become another major drug of use and poses a serious cause for concern among injecting drug users living in the China/Myanmar border region. IDUs may continue to be a critical subpopulation of transmission of HIV and other infections in this area because of the increasing population, persistent high risk of injecting and sexual behaviours, and low utilisation of harm reduction services.

Key words: Injection drug users, ATS use, HIV/AIDS, border region

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INTRODUCTION

1. Background

1.1 Study background

1.1.1 Illicit substance use and HIV transmission: problems at global, regional and national levels

Psychoactive substance use, especially illicit substance use, has always been a public health and social concern throughout the world. The consequences of substance use can affect not only the user but also society, including loss of productivity, crime, family and social problem, and transmission of infectious diseases, especially Human Immunodeficiency Virus (HIV)/AIDS. Substance use associated with HIV/AIDS is not only due to risky sexual behaviours but also due to injection-related behaviours.[1-3] By the end of 2012, there were about 35.3 million people living with HIV/AIDS and more than 30 million died from AIDS-related diseases.[4]

Drug users are high risk group for HIV transmission due to their risky injection and sexual behaviours. The risky injection behaviours include sharing needle and syringe

and sharing other paraphernalia such as bottles, spoons, cotton, The risky injection behaviours include sharing needles and syringes, and sharing other paraphernalia such as bottles, spoons, cotton, and rinsing water.[5, 6] Injection drug use has been proven to lead to HIV transmission since early stage in epidemic, and accounting significant proportions of new HIV infections worldwide, especially in South America, Eastern Europe, and East and South-East Asia, where estimated HIV prevalence among some injection drug users (IDUs) already exceeds 40%.[7, 8] In 2007, there were an estimated 16 million people who might inject drugs worldwide and about 3 million of them are assumed to be HIV positive.[9]

High risk sexual behaviours, which include having sex without using a condom, having multiple sex partners and exchanging sex for money or drugs, have also been broadly proven to be associated with illicit substance use and can lead to extremely high risk situations for HIV transmission.[10-15] Injecting drug use can indirectly contribute to the spread of HIV through sexual transmission from IDUs to general populations.[16-18] Moreover, among drug users especially those who use stimulants such as crack, cocaine, and methamphetamine, may engage in high risk behaviours with more than one sex partner.[19, 20] Other populations, such as commercial sex workers (CSW) may have less ability to negotiate condom use, or offer unprotected sex for higher pay due to their dependence on drugs.[21, 22]

In Asia, the number of IDUs has increased since the late 1980s. Of the estimated 15.9 million IDUs worldwide in 2007, as many as four million were found in East and

South-East Asia, and about 0.7 million of them might be HIV positive. (Table 1) Countries with high level of HIV epidemic among IDUs include China, Myanmar, Vietnam and Indonesia.[9, 23]

Table 1. Regional and global estimates of the number of people who injected drugs, and the number who may be HIV positive, 2007

	Estimated number of people who inject drugs			Estimated number of people who inject drugs and who are HIV positive		
	Lower	Mid	Upper	Lower	Mid	Upper
Eastern Europe	2 540 000	3 476 500	4 543 500	18 500	940 000	2 422 000
Western Europe	816 000	1 044 000	1 299 000	39 000	114 000	210 500
East and southeast Asia	3 043 500	3 957 500	4 913 000	313 000	661 000	1 251 500
South Asia	434 000	569 500	726 500	34 500	74 500	135 500
Central Asia	182 500	247 500	321 000	16 500	29 000	47 000
Caribbean	137 500	186 000	241 500	6000	24 000	52 500
Latin America	1 508 000	2 018 000	2 597 500	181 500	580 500	1 175 500
Canada and USA	1 604 500	2 270 500	3 140 000	127 000	347 000	709 000
Pacific Island states and territories	14 500	19 500	25 000	<250	500	500
Australia and New Zealand	105 000	173 500	236 500	500	2500	6000
Middle East and north Africa	89 000	121 000	156 500	1500	3500	6500
Sub-Saharan Africa*	534 500	1 778 500	3 022 500	26 000	221 000	572 000
Extrapolated global estimates	11 008 500	15 861 500	21 222 000	764 000	2 997 500	6 589 000

(Source: Mathers et al., 2008) [9]

As the most populous country in the world, and a historical major transit route for drugs produced in the Golden Triangle, China continues to have a serious drug consumption problem and has observed a rapid increase of HIV/AIDS in the past two decades.[24] Drug users have made the largest contribution to the HIV epidemic in China via injecting drug use and their unsafe sexual behaviour. By the end of 2011, it was estimated that about 780,000 people were living with HIV/AIDS in China. In the meantime, among the reported modes of HIV transmission, the ratio caused by sexual transmission keeps increasing every year. In 2007, heterosexual transmission accounted for 37.9% of the total and this number dramatically increased to 46.5% in 2011. Likewise, homosexual transmission was only 3.3% in 2007 and reached 17.4% in 2011.[25, 26]

1.1.2 Amphetamine-type stimulants use at global, regional and national levels

As a group of synthetic substances which consists of amphetamine-group and ecstasy-group substances,[27] amphetamine type stimulants (ATS) are one of the most widely used substances in the world. According to the report from UNODC in 2011, there were an estimated 33.8 million people worldwide who ever used amphetamine-group substances at least once in the previous one year, while 19.4 millions people ever used ecstasy-group substances in the past one year. The corresponding annual prevalence for these two groups of substances among people aged 15-64 was 0.7% and 0.4%, respectively.[28]

The East and South-East Asia regions are not only home to about one fourth of the world's population, they are also home to 50-80% of the estimated total number of ATS users in the whole Asia.[29] Nowadays, this region has emerged as a global hub for methamphetamine production and trafficking, along with rising ATS use problem over the past decade.[30-33]

Table 2. Estimated number of people who used amphetamine-group substances at least once in the past year and prevalence among the population aged 15-64, by region, 2008.

Region/ subregion (Amphetamines-group)	Estimated number of users annually (lower)	-	Estimated number of users annually (upper)	Percent of population aged 15-64 (lower)	-	Percent of population aged 15-64 (upper)
Africa	1,550,000	-	5,200,000	0.3	-	0.9
Eastern Africa	Subregional estimate cannot be calculated					
North Africa	260,000	-	540,000	0.2	-	0.4
Southern Africa	310,000	-	1,090,000	0.3	-	1.0
West and Central Africa	Subregional estimate cannot be calculated					
Americas	4,760,000	-	5,890,000	0.8	-	1.0
Caribbean	30,000	-	510,000	0.1	-	1.9
Central America	320,000	-	320,000	1.3	-	1.3
North America	3,090,000	-	3,200,000	1.0	-	1.1
South America	1,320,000	-	1,860,000	0.5	-	0.7
Asia	4,430,000	-	37,990,000	0.2	-	1.4
Central Asia	Subregional estimate cannot be calculated					
East/ South-East Asia	3,430,000	-	20,680,000	0.2	-	1.4
Near and Middle East	Subregional estimate cannot be calculated					
South Asia	Subregional estimate cannot be calculated					
Europe	2,500,000	-	3,190,000	0.5	-	0.6
Eastern/South-East Europe	900,000	-	1,480,000	0.3	-	0.5
Western/Central Europe	1,600,000	-	1,710,000	0.6	-	0.6
Oceania	470,000	-	630,000	2.0	-	2.8
Global	**13,710,000**	**-**	**52,900,000**	**0.3**	**-**	**1.2**

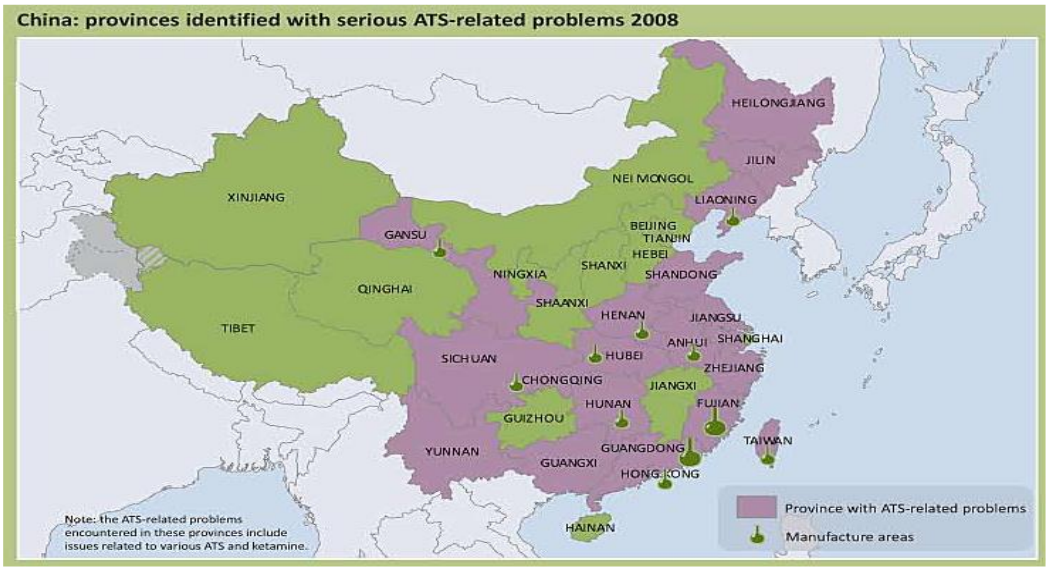
Table 3. Estimated number of people who used ecstasy-group stimulants at least once in the past year and prevalence among the population aged 15-64, by region, 2008.

Region/ Subregion (Ecstasy-group)	Estimated number of users annually (lower)	-	Estimated number of users annually (upper)	Percent of population age 15-64 (lower)	-	Percent of population age 15-64 (upper)
Africa	350,000	-	1,930,000	0.1	-	0.4
Eastern Africa	Subregional estimate cannot be calculated					
North Africa	Subregional estimate cannot be calculated					
Southern Africa	220,000	-	420,000	0.2	-	0.4
West and Central Africa	Subregional estimate cannot be calculated					
Americas	3,040,000	-	3,280,000	0.5	-	0.5
Caribbean	10,000	-	240,000	0.1	-	0.9
Central America	20,000	-	30,000	0.1	-	0.1
North America	2,490,000	-	2,490,000	0.8	-	0.8
South America	510,000	-	530,000	0.2	-	0.2
Asia	2,370,000	-	15,620,000	0.1	-	0.6
Central Asia	Subregional estimate cannot be calculated					
East/ South-East Asia	1,460,000	-	6,850,000	0.1	-	0.5
Near and Middle East	Subregional estimate cannot be calculated					
South Asia	Subregional estimate cannot be calculated					
Europe	3,850,000	-	4,080,000	0.7	-	0.7
Eastern/ South-East Europe	1,680,000	-	1,890,000	0.6	-	0.6
Western/ Central Europe	2,180,000	-	2,190,000	0.8	-	0.8
Oceania	840,000	-	910,000	3.6	-	4.0
Global	**10,450,000**	**-**	**25,820,000**	**0.2**	**-**	**0.6**

(Source: UNODC, 2010) [34]

China is one of the largest methamphetamine markets in the world. There has been a rise in the number of methamphetamine laboratories and in the seizures of drugs in recent years.[29, 34-36] In China, although heroin still remains the primary drug of choice, the use of other substances so-called "new-type drugs", mostly amphetamine-type stimulants, has increased significantly.[2, 37, 38] Of all registered drug users, the proportion of new-type drug use increased from 6.7% in 2005 to 19% in 2008.[39] ATS use, which is strongly correlated with high-risk sexual behaviour, is becoming the most popular drug in Chinese young generations[40-42] and have been proven to have contributed to the rapid increase in sexual transmission of HIV in China.[43]

Figure 1. Provinces identified with ATS-related problems in China, 2008



(Source: UNODC, 2008) [35]

1.2 Study setting background

1.2.1 Study area

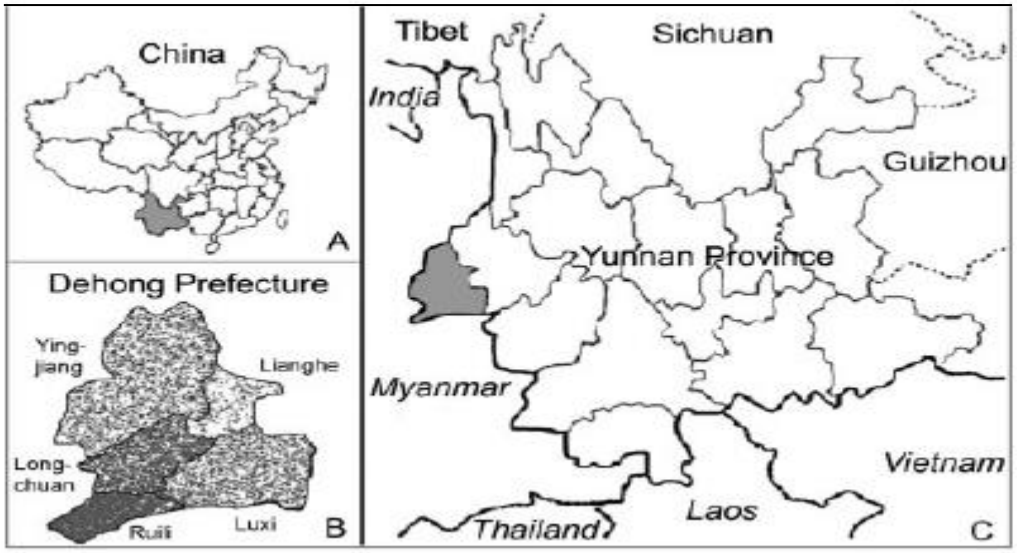
Yunnan province consists of 16 prefectures which includes 129 cities and counties with an estimated total population of 42.9 million. Being located in south-western China and having a 4060 km long border with Myanmar, Laos and Viet Nam, Yunnan province has long been seriously problem as drug trafficking, drug use and drug related harm such as HIV/AIDs in China.[44-46] The HIV prevalence among injection drug users, who are mainly heroin users in southern China, is highest in Yunnan Province. The average HIV prevalence among IDUs was 18.2% - 26.9% from 2000 to 2007, and the incidence for each two-year period was 14.65% (2000~2001), 6.21% (2002~2003), 4.06% (2004~2005), and 2.23% (2006~2007) respectively.[47] In some areas, the HIV prevalence among IDUs had exceeded 50%.[48] Nowadays, as China and Myanmar have become the world‘s largest producers of methamphetamine, Yunnan is also facing a critical situation caused by ATS. ATS, especially methamphetamine pills smuggled from Myanmar has become more popular there.[49] Since 2002, the quantity of methamphetamine trafficked from Myanmar through Yunnan province increased at a rapid rate. The share of methamphetamine seizures in Yunnan (as part of the Chinese total) increased from 18% in 2002 to 56% in 2006.[36]

1.2.2 Study site

There are 11 national-level ports and nine provincial-level ports in Yunnan province

for Chinese trade with Myanmar, Laos and Vietnam. As the biggest national-level trading ports with Myanmar, Ruili is situated in Dehong Dai and Jingpo Autonomous Prefecture, which is located in the west part of Yunnan province and linked with Myanmar on the southwest, southeast and northwest parts by sharing a boundary line of 141.1km. In 2011, the population of Ruili was approximately 181,239. Like elsewhere in China, Ruili is home to a great diversity of ethnicities. There are more than 20 ethnic groups in this area comprising mainly Dai, Jingpo, Han Chinese and migrants from Myanmar. Since abutting the town of Muse, a major drug-producing centre in north-eastern Myanmar, trade in goods ranging from jade to drugs forms a major part of the local economy in Ruili city. During the past two decades, Ruili has been transformed from a mostly agriculture based economy, to one based on the service sector. Agriculture now represents only a minor part of the local economy with trade, tourism and industry being the major contributors. Meanwhile, the sex trade has also grown with the inflow of migrant workers, traders and tourists along this border area. The expansive economic activities and its special geographical location have caused Ruili to experience severe public health problems, particularly transmission of HIV/AIDS. Since the first HIV outbreak in China identified in Ruili in 1989, this area has reported a cumulative total of 4554 HIV/AIDS cases up to 2009, of which 771 (16.93 %) were Burmese residing in China.[44, 50]

Figure 2. The geographic location of Ruili city, Dehong prefecture and Yunnan province.



(Source: Jia et al., 2008) [51]

2. Literature review

2.1 General conception of ATS

As previously noted, ATS can be divided into two subgroups, namely amphetamine-group and ecstasy-group substances. Use of ATS, especially long-term use, may lead to a number of health problems such as cardiovascular disease, or development of psychosis due to severe structural and functional changes to the brain. Convulsions may also occur and can result in death if not being treated immediately.[27] Noticeably, ATS users are at extremely high risk for transmission of HIV and STDs, both due to potential needles and syringes sharing if it gets injected,[52-56] and high risky sexual behaviours associated with drug use because of its pharmacological action.[57-59] The drug effects for each ATS group are summarised in table 4.

Table 4. The drug effects for each ATS group

	Amphetamine-group (CNS Stimulants)	**Ecstasy-group (Hallucinogenic ATS)**
Main drugs in this group	• Amphetamine; • Methamphetamine; • Methcathinone.	• 3,4-methylenedioxymethamphetamine(MDMA); • 3,4-methylenedioxyamphetamine(MDA); • 3,4-methylenedioxyethylamphetamine(MDEA).
Sought-after effects	• A feeling of well-being, exhilaration and euphoria; • Increased alertness and energy; • Delayed hunger and fatigue; • An enhanced ability to perform manual and intellectual tasks.	• A feeling of emotional closeness to others; • Increased sociability; • Increased physical and emotional energy.
Possible short-term effects	• Loss of appetite; • Faster breathing; • Increased heart rate; • Raised blood pressure; • Dilated pupils; • Strange, erratic and at times violent behaviour.	• Fatigue and depression after use of the drugs is stopped; • Restlessness, anxiety and intense visual and auditory hallucinations with larger doses; • Nausea and vomiting; • A rise in blood pressure and heart rate; • Death from heatstroke.

	Amphetamine-group (CNS Stimulants)	**Ecstasy-group (Hallucinogenic ATS)**
Possible long-term effects	• Destruction of the tissue in nose if the drugs are sniffed; • Respiratory problems if the drugs are smoked; • Contraction of infectious diseases if the drugs are injected; • Abscesses if the drugs are injected; • Malnutrition and weight loss; • Disorientation; • Indifference; • Confusion and exhaustion due to a lack of sleep; • An increased tolerance to the drugs; • A psychological dependence on the drugs; • Paranoid psychosis.	• Damage to nerve tissue; • Brain damage; • Liver damage.

(Source: National Centre on Minority Health and Health Disparities United States, 1998) [27]

2.2 Diversity of ATS use

2.2.1 Type of use

The type of amphetamine-type stimulants (ATS) use varies considerably in different regions. In Europe, the amphetamine use is more common except in Czech Republic and Slovakia, where the synthetic stimulant users mostly use methamphetamine. Methamphetamine is also the common synthetic stimulant consumed in South Africa, in Oceania and in North America.[34] In East and South-East Asia, the primary ATS of use are methamphetamine and ecstasy. Methamphetamine can be presented as a pill, a powder or in crystalline form, allowing it to be swallowed, smoked, snorted or injected. Ecstasy is usually available as a pill or tablet and is almost exclusively ingested. The street names of the available ATS in East and South-East Asia are shown in Table 5.[31]

Table 5. Street names of the available ATS in East and South-East Asia

Crystalline methamphetamine	• Yaba or Yama chak *(Cambodia)*; • Bindu *(China)*; • Shabu *(Indonesia, Japan, and Philippines)*; • Anpon, Philopoon or Speed *(Japan)*; • 'P' *(New Zealand)*; • Bato, Sha, or Siopao *(Philippines);* • Ice *(Australia, Cambodia, Japan, and Thailand)*.
Methamphetamine pills	• Yama *(Cambodia, Lao PDR, and Myanmar)*; • Yaba *(Cambodia, Lao PDR, and Thailand*); • Bingdu pian *(China)*; • Seik kwya say or Myin say *(Myanmar)*.

Ecstasy(MDMA)	• Thnam krovee kbai *(Cambodia)*; • Yao tou wan *(China)*; • XTC *(Indonesia)*; • Ya-E *(Lao PDR and Thailand)*; • X *(Japan)*; • Yao tou ubin *(Myanmar)*; • XTC or Love drug *(Philippines)*; • Ya-love *(Thailand)*; • Shaking pill *(Vietnam)*.

2.2.2 Population, motivation and factors associated with ATS use

A number of motivations for ATS use by diverse populations have been outlined in previous studies. Ecstasy, methamphetamine and other substances (e.g., Ketamine, LSD) are known as "club drugs" since they are usually used by adolescents and young adults at all-night dance parties, to help boost the energy for dancing or to enhance the altered state of consciousness.[2] Studies have also found that club drugs, especially ecstasy, are widely available in college and high school campuses.[60-62]

Because of its effects of increasing energy, alertness, or decreasing appetite, amphetamine-group substances such as methamphetamine have become popular among individuals whose jobs require long-time working hours, or among those who want to lose weight, especially among women.[63-65] In Thailand, methamphetamine tablets are used by manual workers such as long-distance truck drivers, industrial workers, farmers and fishermen, to boost their energy for working harder and longer.[66] A similar situation also can be found in the China-Myanmar border area, particularly on the Chinese side. Use of 'yaba' (crystalline methamphetamine) is

common among miners, commercial sex workers at the many jade and gold mines, as well as among workers in the illegal logging industry.[49]

ATS can be used to enhance some particular functions such as changing mood or handling social situations. For instance, crystal methamphetamine was identified to be used as a self-medication of negative feelings about HIV positive sero-status.[67] ATS are also usually reported to be used to enhance sexual experience. Compared to other stimulants such as cocaine, use of methamphetamine is more often associated with sexual motivations, including enhancing sexual performance, and increasing sexual activity. Studies on methamphetamine use among different populations, such as men who have sex with men (MSM), adolescent, and heterosexual drug users revealed that the drug was served as a means of sexual enhancement.[57-59, 67]

Some studies have reported using ATS as a substitute for other drugs. In Australia, a heroin shortage around 2000 due in part to drug law enforcement caused the heroin price to increase, while purity decreased, and prompted many heroin users to either switch to ATS or increase their ATS consumption.[68, 69] Similarly, from a qualitative study conducted in Tijuana, Mexico, IDUs mixed heroin with cheaper substances, especially methamphetamine to reduce the cost.[70]

A range of influential factors that can reduce or increase the probability of ATS use have been found in previous studies. Protective factors include having positive family influences, being employed, and having high socio-economic status etc. Risk factors include high availability of the drug, poor family function, unemployment, and poor

social and economic status. The diversity of these factors emphasise the demands of developing multifaceted response to ATS use and related problems.[71, 72]

2.2.3 Route of administration

ATS can be ingested, snorted, smoked, or injected by drug users. The route of administration is usually linked to the level of drug dependence, the type of drug used, and the context of use. In general, oral and intranasal ways are often reported by occasional users and tend to result in less severity of dependence, whereas injection use is usually associated with higher dependence levels.[73-75] However, more chaotic patterns exist among methamphetamine users.[73, 76, 77] For example, a study conducted among methamphetamine injectors, smokers, and those who did both reported the highest risk associated with drug use among the both group, even though there were comparable levels of sexual risks, psychoses, and involvement in drug-related crimes in each group.[73]

Although most ATS users are non-injectors,[78, 79] injection of ATS, particularly amphetamine-group substances, has an important role in harms and has been reported by various risk populations.[77, 80-82] Studies conducted among IDUs have shown that injection of methamphetamine is associated not only with risky sexual behaviours, including having multi-sexual partners, or becoming involved in the sex trade, but also with increased risky injection behaviours, such as sharing needles/syringes and failure to clean used injection equipment.[82] Amphetamine injectors are also more

likely to be younger and have homosexual behaviours than injectors of other drugs.[80, 83]

2.2.4 Use of ATS in combination with other drugs

People usually use ATS in combination with other drugs, that is, polydrug use is very common among ATS users. In Australia, use of crystal methamphetamine has increased in regular ecstasy users, and heroin use also has been reported among crystal methamphetamine users.[84] In USA and Canada, amphetamine-group substances have been reported to be taken with heroin, ketamine, cocaine and ecstasy.[85, 86] Drug users often take other drugs with ATS to improve sleep or reduce anxiety, or to experience pleasure provided by some certain combinations, or make it as a substitution of other drugs during resource shortages.[36, 70, 86] For example, in Malaysia, nimetazepam is taken by methamphetamine users to induce sleep after binge sessions.[36] In a qualitative study conducted in two U.S-Mexico border cities, almost all IDUs injected methamphetamine in combination with heroin because of the lower cost.[70]

Use of ATS with other drugs can be particularly challenging because the association of drug use with its harm can be further complicated. For example, the combination of methamphetamine and cannabis can increase psychotic symptoms in some individuals, particularly in those with schizophrenia. The combined use of methamphetamine and heroin can cause respiratory depression, which may induce cardiac failure, especially among people with cardiac diseases. In addition, the effects

of heroin might be dulled by methamphetamine when people use them together, and it may lead to an increased risk of heroin overdose. The combination of methamphetamine and cocaine can mutually increase the cardio-toxic effects of both drugs. Some other psycho-stimulants also can have interaction with methamphetamine and increase the user's risk of stroke, psychosis, and heart attack.[87, 88]

2.3 Association of ATS use with HIV infection

ATS users are extremely at high risk for transmission of HIV and STDs, both due to potential needles and syringes sharing if it gets injected, and the high risky sexual behaviours associated with drug use because of its pharmacological action.

ATS, especially amphetamine-group substances, are linked to HIV and STDs since they are usually used to enhance sexual performance or to cope with sexual inhibitions.[57-59] It also has an independent association with behaviours that are directly relevant to HIV exposure, such as unprotected sex, or having multiple sexual partners.[89-93] In a longitudinal study, methamphetamine use was found to be positively associated with unprotected sex at different time points.[93] Other studies which used event-level analysis also showed that sexual risk behaviours were independently associated with ATS use.[79, 89, 90] Some studies showed that different intensity and frequency of ATS use had different effects on sexual risk. For instance, binge users usually reported having more unprotected sex than non-binge users.[91] Furthermore, findings from other study showed that different levels of ATS use, including heavy

use, intermittent use and episodic use were associated with increased risk of HIV infection.[94]

Independent associations of ATS use and HIV-related risk behaviour have been widely reported in different populations, including heterosexual adults, IDUs and MSM.[89, 95-99] Previous studies on the behaviours of IDUs indicate that ATS use is associated with increased risky sexual activity in this group. For example, in a study conducted among male IDUs in Stockholm, drug users who were using amphetamine reported having more female sex partners than those who were using opiates.[97] A study on female IDUs in England found that amphetamine users had a higher frequency of sexual intercourse than opiates injectors.[98] In a survey conducted among street-recruited IDUs, methamphetamine injectors reported having more sex partners, engaging in more sexual intercourse, and having decreased condom use than those who never used methamphetamine.[99] Moreover, not only limited to sexual risk behaviour, findings from some studies also showed injection drug users who also used methamphetamine were more likely to report higher levels of high risky injection behaviours, or had higher HIV prevalence than those who injected other drugs.[52-56, 82, 100, 101] In Ukraine, injectors of amphetamine-group substances had a higher HIV prevalence compared with opioids injectors.[100] In a survey of IDUs in Bangkok, the HIV prevalence among amphetamine injectors, opium injectors and heroin injectors was 64%, 47% and 37%, respectively.[101]

2.4 Prevention and control strategies for ATS use

2.4.1 A comprehensive prevention at three phases

The prevention and control strategies for drug use can be defined as "measures that prevent or delay the onset of drug use as well as measures that protect against risk and reduce harm associated with drug supply and use".[102] Generally, these strategies can be classified into three phases as follows:[75]

- **Primary prevention:** aims to prevent the initiation of drug use, including education programmes and supply control strategies.
- **Secondary prevention:** aims to prevent related problems in people who already engaged in drug use, such as targeted interventions to avoid injecting drugs and dependence.
- **Tertiary prevention**: to prevent behaviours that would lead to significant individual or social harms among dependent drug users, including reducing the risk of HIV, hepatitis B and C and overdose.

2.4.2 Specific strategies for ATS use

ATS and other psycho-stimulant use can generally be categorized into six main patterns as follows:[103, 104]

- Experimental use: using drug infrequently and out of curiosity; most do not experience extensive problems or continue use.

- Occupational use: use is for the purposes of better/longer work performance such as that by truck drivers, students, construction workers and athletes.
- Occasional use: as exemplified by rave or club scene use; use is restricted to weekend or event-specific use.
- Heavy use: excessive use over a short period of time, usually a couple of days.
- Chronic use: heavy and prolonged use.
- Problematic use: often characterized by chaotic and compulsive (dependent) use, often associated with injecting drug use and sometimes with smoking of amphetamines (especially methamphetamine); such use results in psychological, social and often legal problems.

These patterns of ATS use may merge or change as circumstances or social networks change, and related harm varies considerably in most countries in which use occurs and users come from all socio-economic groups, with a wide range of educational and cultural backgrounds, therefore a wide variety of prevention strategies, including harm reduction measures addressed in this problem is needed.[88, 103]

- **Broad strategies**

Broad prevention strategies include mass media campaigns, school-based activities, peer education, and other strategies targeted at specific groups with high risk behaviours and problems related to drug use. Mass media campaigns aim to promote awareness of the general population by providing information. School-based activities

are implemented to prevent the initiation of drug use in the education context. Peer education approaches are used to prevent the uptake of drug use and to reduce drug related problems in current drug users.[102]

- **Harm reduction strategies**

Harm reduction strategies generally aim to decrease the risks and harms associated with drug use among people who are engaging in drug use and experiencing related problems. From previous practical experience, harm reduction programmes can respond to harms associated with ATS use. Table 6 presents some key points of harm reduction interventions for people who use ATS which are recommended by the International Harm Reduction. These approaches are useful for not only drug users, their friends and family, but also health care service providers, and enforcement personnel in contact with ATS users.[105]

Table 6. Responding to harms associated with the use of ATS

Area	Behaviour	Harm	Harm Reduction Strategy
Hydration, nutrition and hygiene	• Forgetting to eat and drink • Eating only junk food • Not sleeping	• Malnutrition and dehydration • Increased risk of anxiety, paranoia and psychosis • Decreased high, need for higher dose to achieve the same effects • Intensified 'crash'	• Provide water, juice and healthy food where possible, especially for homeless, marginally housed and impoverished users • Stress the need to sleep or at least rest in a darkened room, eat healthy food (especially fruits and vegetables) and drink water regularly. Point out that these are not abstract health concerns, but have immediate positive effects on the experience of day-to-day use
	• Forgetting to drink water and brush teeth • Eating sugary foods • Grinding teeth	• Dry mucous membranes more vulnerable to infection • Dental problems	• Stress the importance of hydration and dental hygiene • Distribute toothbrushes and toothpaste
Moderating patterns of use	• Binges (heavy use over a period of days or weeks)	• Increased risk of amphetamines-induced psychosis, as well as paranoia, anxiety and other health problems	• Encourage users to plan for breaks in advance. Develop methods to help them keep track of how long and how much they have been using, take a break at the limit they have set for themselves, eat well before using and stay hydrated while using. When introducing and implementing these new plans it can be helpful for the user to have a 'harm-reduction buddy', someone they trust who can support their efforts
	• Heavy use	• Withdrawal and 'crashes'	• Stress that depression, fatigue, moodiness and aches are a natural part of withdrawal and will pass with time • Inform users that focusing on pleasant, distracting activities; keeping close to supportive people; and maintaining a healthy diet and routine will help them to manage withdrawal and crashes • After the crash is over, help users develop their own strategies to reduce crashes, using the same tactics effective for episodes of paranoia and psychosis

Reducing harms related to modes of use	• Sharing injecting equipment • Sharing mouthpieces, including jagged ones • Smoking with toxic materials • Using pipes that can easily cause burns	• Risk of blood-borne diseases, lung damage, toxicity, cuts and burns	• Distribute sterile injecting equipment and information on safer injecting • Distribute glass stems with gauze or individual pipe tips • Teach users how to make safer pipes • Distribute lip balm and burn salve
	• Transition to smoking and injecting or to more potent forms (e.g. crystal meth)	• Dependence develops more quickly and is more severe among users who inject and who use more potent forms • Increased risk of blood-borne viruses	• Inform users who swallow or snort about the risks of injecting and smoking and about safer injecting and smoking techniques • Encourage users not to transition to a more intense route • Give users who inject or smoke appropriate information about safer methods and encourage them to transition to snorting or swallowing if possible • Inform users that smoking from a pipe produces a faster and more intense high than smoking on foil and inhaling smoke through a tube or smoking from a joint, and that switching to one of these methods is another harm reduction strategy
	• Injecting many times in one sitting	• Increased risk of vein and tissue damage, missed shots, infection and other injection-related harms	• Use a butterfly needle scheme, eliminating the need to enter the vein repeatedly and repeat the risk of associated harms. Distribute appropriate supplies and teach participants how to use them
Managing paranoia, delusions and anxiety	• Picking at 'speed bugs'	• Open wounds that can become infected	• Use measures described above to deal with delusions • It may be helpful to create non-invasive 'treatments' for the bugs to calm the user during acute episodes
	• Exhibiting signs of paranoia, delusions and/or acute anxiety	• Risk of harm to self or others	• Be calm and reassuring • Take user to a quiet, calming place and try to turn their attention to something else • Take users seriously and do not tell them that they are delusional as this can upset them more. Validate their experience while avoiding acknowledging that it is real (if you are certain that it is not) • Help users recognise the ways in which paranoia and anxiety are associated with patterns of drug use and with harms such as violence or arrest • Do not sit behind a desk, take notes or have the client face doors or windows • Apply cool compresses to the neck, underarms, backs of the knees and forehead to help lower body temperature • Provide plenty of hydrating fluids (nothing caffeinated or sugary) • If available, small doses of benzodiazepines can be helpful, as can 50–100 ml of diphenhydramine (Benadryl/Dimedrol) • When user is not high, discuss strategies to reduce the occurrence of anxiety, paranoia and psychosis, including diet, hydration, sleep, breaks, moderation of dose, routes of administration and setting

			• Users who are acutely psychotic or aggressive, appear to be a danger to themselves or others, or are experiencing symptoms of acute toxicity need medical attention. For psychological symptoms this includes benzodiazepines and, in acute cases, anti-psychotics. If vital signs are significantly elevated, an IV line, cardiac monitoring and emergency care may be needed. If appropriate, it is important to check for breathing and use rescue breathing if needed • Harm reduction providers should not risk their own safety if a situation appears to be dangerous
Managing harms of associated activities and 'functional' use	• Sexual risk	• HIV and STIs	• Provide free access to condoms, lubricant and information about STIs and HIV • Emphasise the special importance of using plenty of lubricant during long, dry or rough sex • Provide low-threshold access to HIV and STI testing and treatment, as well as to contraception and pregnancy testing and counselling • Understand and acknowledge the role that amphetamines play in the sexual lives of users. Rather than perceiving amphetamines as the sole source of risk, understand that many people use them to facilitate sexual activity. Discuss pleasure and functionality along with risk to allow more sophisticated strategies of risk reduction • Develop a sexual harm reduction plan in advance, discussing realistic ways to reduce sex-related harms in the context of users' lives • Talk not only about HIV and STIs, but also about sexual and physical violence, transactional and commercial sex, abusive relationships, housing and other issues intimately related to sexual risk behaviours. Addressing the context of sexual risk and developing a plan to make behaviours less dangerous is often the best way to support users in reducing risk
	• Using amphetamines to control weight	• Dependence, excessive weight loss, other harms associated with use	• Recognise that some people, especially women, use amphetamines to lose or control weight and fear gaining weight if they stop using • Discuss this fear with users and help them to develop a plan to prevent or manage weight gain, while exploring the issues underlying poor body image
	• Use of amphetamines for work or study	• Dependence, other harms associated with use	• Remind users that while amphetamines can initially help sustain attention and endurance for long periods of time, heavy use eventually makes it very difficult to complete a task, focus or behave appropriately in work or study settings • Organise separate support groups to respond more accurately to the needs of people who use amphetamines for different reasons. Truck drivers who use methamphetamine while working, for example, are likely to have very different concerns than teenagers who use it at raves or sex workers who use it to endure harsh working conditions

(Source: The International Harm Reduction Association, 2010) [105]

- **Treatment**

Although there is no widely accepted treatment for ATS dependence,[106, 107] some therapies are still effective.

The current gold standard treatment for ATS-related problems is a brief psychological intervention developed and tested in Australia.[108] Another approach named "Alcohol, Smoking and Substance Involvement Screening Test linked brief intervention (ASSIST-linked BI)", which was developed by WHO and can be easily linked to the score from the ASSIST screening questionnaire, has also shown its feasibility and effectiveness on ATS-related problems.[109]

In China, various strategies, including law enforcement approaches, community based awareness raising programmes, and harm reduction strategies (e.g., needle syringe exchange programme and methadone maintenance treatment), have been used to prevent drug use and related problems. However, with the exception of media coverage and dominant law enforcement and supply reduction approaches, these prevention and intervention services are still focused on drug users who primarily use heroin and pay less attention to ATS users. It is probably due to the limited awareness of harms related to ATS use by the whole society. In China, heroin users are much more stigmatized and at higher risk of being arrested. The police generally impose fines instead of arresting ATS users. Unlike heroin users, most ATS users in China are not treated as marginalized people in society, especially in big or moderate cities. ATS are generally perceived as a 'harmless recreational drug' since they are usually

taken occasionally and their effects are seen much less acute than heroin. From previous studies, a series of public health and social problems associated with ATS use have yet got addressed by current research and services in China. Until today, there is still a lack of law, prevention and intervention strategies specific to ATS use in China compared with the response to opiates (heroin) use.[39, 46, 110-115]

2.5 Drug use problems and related risk in cross border area

International borders have caught wide attention of public health researchers since they represent "a unique risk environment where policy, geography, culture, social norms, and disease interact to contribute to health risks".[116]

Previous studies have shown a relationship between drug production and trafficking, drug abuse patterns and trends on international border areas. In Mexico, 90–95% of injection drug use occurred in the border region between Mexico and USA, where production and trafficking of illicit drugs are very common.[117] For example, Baja California, a city bordering USA, has the highest prevalence of methamphetamine use in Mexico.[70] In Tijuana, campaigns against methamphetamine production in the USA have directly led to increased local production of methamphetamine and the consequent emergence of a local consumption market there.[118, 119] Evidence also has been found by an ethnographic study which indicated that methamphetamine has become a major drug of choice in Tijuana.[70]

Drug users who live close to the border are highly mobile and can cross freely between neighbouring countries. A previous study conducted among 222 IDUs in Tijuana found that 12% of them had ever crossed the border to the USA in the past six months prior to the interview; IDUs who had a history of deportation to Mexico were more likely to inject drugs more frequently, and less likely to receive health services, which may imply a greater chance of acquiring and transmitting blood-borne infections.[120] In a survey conducted among 1056 IDUs who resided in Tijuana, 78% of them had ever crossed to the USA and more than half (58%) had used drugs there.[121] A high level of mobility related to looking for employment, safety, and illicit drugs among IDU populations has been found to be linked to an increased risk for blood-borne infections and other diseases. In the US-Mexico border region, cross-border mobility of IDUs was associated with increased odds of tuberculosis.[122] In the border region between China and Vietnam, IDUs from China with HIV infection were more likely to cross the border to purchase drugs, and this is believed to make a contribution to HIV epidemic among IDUs in Vietnam.[123, 124] Links between drug production, trafficking, consumption market, and the spread of HIV along drug trafficking routes in several regions of the world have been well described in a review article.[125]

2.6 Studies on ATS use in China

With the growing concern of ATS-related problems in China, previous studies have mentioned ATS-related problems among drug users from different settings. A survey

about polydrug use among heroin addicts conducted by Ye et al in 2002 reported that among 480 inpatients drawn from a heroin detoxification treatment centre, the lifetime prevalence of ecstasy use was 18.8%.[126] Another study conducted among 203 methadone maintenance treatment (MMT) clients showed that the lifetime prevalence of MDMA and methamphetamine use before entering MMT was 11.8% and 6.4% respectively.[127] In addition, some studies specifically focused on patterns and consequences of ATS use even though the number of these studies is very limited. (Table 7)

Table 7. Summary of epidemiological / behavioural studies focused on ATS use in China

Research Topic	Author/Year	Material and Methods	Main Findings
An epidemiological study about central nervous stimulants and other related psychoactive substance use.[128]	Liu,2002	A multi-centre survey carried among 1404 stimulants users who were in or out-treatment in 10 provinces in China, to understand the basic situation, characteristics and consequences of these substances use. Facility-based sampling technique was used in this study.	The abused drugs were not only MDMA (68.3%) and methamphetamine (12.5%) but also other varieties of club drugs such as cocaine, ketamine, and cannabis. ATS use had caused harm on these drug users such as overdose and psychoactive substance use disorder. 3.2% of these drug users initially used these drugs in injection way and this rate had increased to 17.2% when they got interviewed. 54.9% participants ever had heroin use history before they started using "new drugs".
Social- demographic characteristics and negative consequences of instrumental amphetamine type stimulants users.[129]	Hao, 2002	A cross-sectional study was conducted among 237 instrumental ATS users (who were defined as having ATS use experience more than 6 times during the past one year prior interview), to investigate the social demographic characteristics, drug use	Ecstasy (MDMA) was the most frequently used drug. (90.7%) Oral intake was the main route of administration (89.3%). 19% of participants ever injected ATS during the past year. The reasons for instrumental ATS use included improving concentration, helping stay awake at work or study, improving performance at work/ study, releasing stress,

Research Topic	Author/Year	Material and Methods	Main Findings
		patterns, and physical/psychosocial consequences of use Study sample was got from seven cities in China by using snowball sampling techniques.	controlling weight and enhancing sex ability etc About 40.5% of participants had intimate friends or acquaintances who also used ATS as well. 40.9% had casual sexual partner, 33.8% had experiences of paying for sex during one-month prior interview.
A study on amphetamine- type stimulants use: social demographic characteristics and patterns of Use.[130]	Liu, 2002	A cross-sectional study conducted among 59 recreational ATS users who were defined as having ATS use experience during the past one year prior interview. Study sample was got from seven cities in China by using snowball sampling technique.	MDMA was the main ATS being used (100%). 13.6% of participants ever used crystal methamphetamine (Ice) during past year prior interview. Oral intake was the main route of administration (100%). None of participants ever injected ATS during the past year. The purpose of using included: to feel elated or happy, to feel better when got depressed, to relax and to feel less suppressed etc. Nearly all participants had friends or acquaintances who were also using ATS. 46% of participants had casual sexual partners during one month prior to interview, and only half of them used condom every time

Research Topic	Author/Year	Material and Methods	Main Findings
An epidemiological study among new-type drug users in Beijing city.[131]	Wang, 2008	A cross-sectional study carried among 268 primarily new-type drug users in a compulsory drug detoxification centre in Beijing city. A facility-based sampling technique was used.	The new type drugs here refer to methamphetamine, MDMA and ketamine. Among all participants, 139(51.9%), 62(23.1%) and 67(25.0%) of them mainly abused crystal methamphetamine (MA, Ice), MDMA and ketamine, respectively. The routes of administration were different. MA was mainly used at home (59.7%) by chasing dragon (98.6%), MDMA was mainly used in dancing pub (66.1%) by orally intake (96.8%) and ketamine was mainly used in dancing pub (55.2%) by snorting (91.0%). About 27% of participants showed violent behaviour after using drugs. 64% abusers had sexual impulse and 4.9% had sexual violence associated with drug use.
A preliminary study of methamphetamine use in Yunnan, China.[132]	Li,2008	A cross sectional study conducted among 74 methamphetamine users In three detoxification centres in Yunnan, China. Facility-based sampling	30% of participants started their methamphetamine use before 2000.19% reported having used both methamphetamine and heroin in their lifetime. 66% of them were classified as methamphetamine dependence or abuse based on *DSM-IV* classification system. 22% reported having had at least one fight against others,

Research Topic	Author/Year	Material and Methods	Main Findings
		technique was used in this study.	42% reported having had sexual desire after using it. 90% believed that methamphetamine was just a regular medicine and wouldn't lead to addiction.
An epidemiological study on methamphetamine use in Changsha city, China.[133]	Zhang, 2011	A cross sectional study conducted among 129 methamphetamine users recruited through respondent driven sampling (RDS), to understand the general situation and characteristics of them. Here methamphetamine users was defined as reporting methamphetamine use within last 3 months prior interview. HIV antibody test was carried out for the participants.	None of the 102 participants who accepted the HIV antibody test was HIV positive. 72.9% were polydrug users who had ever used other illicit drugs including ketamine, MDMA, heroin, marijuana and etc. The most commonly used drugs were 'ice'(crystal methamphetamine) and 'Magu', which is a mixture of methamphetamine, caffeine, and some flavouring. No participants ever injected ATS during their lifetime and all of them smoked methamphetamine with a special instrument called 'ice pot' in private settings such as home, rented apartment and hotel. The mean time of methamphetamine use within last 3 months were 21.4 ± 31.3 days (median=10 days), and the mean doses used for ice and 'Magu' were 0.3 gram and 3.8 tablets for each time, respectively. Methamphetamine was highly available, and more than two

Research Topic	Author/Year	Material and Methods	Main Findings
			thirds of the participants(67.4%) reported they can easily or very easily get the drug they want. The main motivations of drug use including peer influence, enhancing sexual performance, and to alleviate bad mood.

Most of these studies mainly explored ATS use among drug users who primarily used or were dependent on central nervous system stimulants, which limited differentiating between drug use patterns (e.g. primary heroin users who also use ATS, and absolute "new-type drug" users) and related risk behaviours. Few studies accessed HIV risk behaviour measures and provided biological results of HIV testing, thus the relationship between specific drug use patterns and HIV infection status has not been evaluated. Very few of the studies examined the risk factors of ATS use. Moreover, most studies used a convenience sampling technique, which although provided an easy way to get access to hidden populations, but limited the generalisability of research findings to larger populations.

2.7 Methodological issue I: RDS and other sampling methods for hard-to-reach populations

Accurate data on the behaviours of high risk populations for HIV/AIDS are critical for planning, monitoring and evaluating targeted prevention and intervention responses. The current gold standard method for acquiring accurate data is probability-based population surveys. However, for those so called "hidden" populations such as IDUs, female sex workers (FSWs), and MSM who are at high risk and can be hard to reach, obtaining representative data from them presents an enormous challenge, because there usually is no existing sampling frame, and they are often a relatively small proportion of the total population which can limit the application of probability-based population surveys. Moreover, due to the illegal and

stigmatized nature of their behaviours, such populations are often under-recognised and under-reported in population-based surveys based on household interviews.

Over the past several decades, some specific methods for recruiting hidden populations have emerged. The commonly used methods include snowball sampling,[134] facility-based sampling,[135] targeted sampling,[136] venue-based sampling,[137] and respondent driven sampling.[138, 139] The main sampling process, advantages and limitations of each sampling technique are briefly summarised in Table 8.

Table 8. Summary of sampling techniques for hard-to-reach populations

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
Snowball sampling	Chain-referral methods (Non-probability sampling)	There are two steps involved in this sampling technique: identify one or more subject(s) in the desired population, and use these units to find further units. • Ideally, an initial sample should be chosen randomly, and then each individual in this sample is asked to name his or her friends who fulfill the inclusion criteria. • These persons referred by subjects in initial sample are approached and asked to participate; individuals who agree are then asked to provide additional names. The process stops when the	• Hidden populations can be reached by using this chain referral process. • Compared to other sampling technique, snowball sampling is more cost-efficient and easier to conduct.	• In practice, the initial sample cannot be drawn randomly; • Sample tends to be biased toward the more cooperative subjects who agree to participate; • "Masking" bias: When a population has strong privacy concerns, individuals may not like to refer their friends. • Subjects with larger social networks will be over-sampled, whereas relatively isolated ones will be excluded. Due to above potential biases, samples obtained from snowball sampling method usually are seen as "convenience samples" that re not considered representative of the population being studied.

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
		required sample size is met.		
Facility-based sampling	Convenience sampling (Non-probability sampling technique)	This method recruits target population from a variety of facilities. For example, STD clinics can be useful sources for recruiting MSM and commercial sex workers (CSW); drug users can be found from drug treatment centres such as MMT clinics; drop-in-centre of needle syringe exchange programme can provide access to IDUs.	• A large number of hidden population members can be recruited within a short time. • The process is cheap, simple and cost-efficient.	• Target population in certain facilities or visiting these facilities very frequently would be different with populations who are not in these venues or do not visit them. It can not provide a representative samples of targeted populations.
Targeted sampling	(Non-probability sampling technique)	There are two basic steps: • First, an initial ethnographic assessment is needed to identify the various subgroups existing in a given setting; • Second, identified	Targeted sampling provides a more powerful sampling mechanism than convenience sampling and a more feasible approach than random sampling.	• The thoroughness of the ethnographic assessment directly affects the magnitude of sampling bias; however, in practice, it is usually limited by the time and resources available.

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
		subgroups to be treated as sampling stratum, within which quota samples will be chosen by using systematic sampling technique.		
Venue-based sampling	(Probability sampling technique)	There are three main phases: the formative phase, the preparatory phase, and the sampling phase. • The formative phase mainly includes collecting ethnographic information, such as analysis of indicator data, or interviews with key informants. • The preparatory phase: first, the range of venues for target population should be identified, and a list of eligible venues based on	Investigators can obtain a large, diverse, and representative sample of the target population.	• The findings can be limited to accessible venues, venue attendance, and more visible or active members of the target population. A high proportion of the target population which doesn't visit these places or visit them rarely can lead to a coverage bias. • Given potential change of circumstances that may affect the sampling process, there is often a need to identify new venues and monthly reconstruct the sampling frame. Establishing and updating the list is time-consuming and costly. • Calculating the weights for

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
		headcounts of persons should be given. Following that, the number of the target population in each venue, and the proportional allocation of the sample between the different strata of venues will be determined. • The sampling phase: two-stage sampling process will be used. The first stage includes the selection of venues from the sampling frame by using simple random sampling or a stratified sampling. Following that, investigators screen and invite eligible participants by using random or systematic sampling. Since mobility		individuals requires asking specific questions about attendance of these venues. This relies on the memory and can produce recall bias.

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
		can affect the probability of selection, investigators need to collect data on respondents' mobility to calculate weights for controlling unequal probability of selection.		
Respondent-Driven Sampling	Chain-referral methods (Probability sampling technique)	• It begins with a small number of peers termed "seeds", which are non-randomly selected from the target population. • As the initial recruiters, "seeds" receive a limited number of uniquely coded coupons to recruit their peers who are eligible for the study. • Each enrolled respondent then receives the same	It can provide more valid probability samples because: • Recruitment is entirely voluntary since the referred respondents must make a personal appearance at the study site; • Using dual incentive system can be expected to reduce non-response bias since people can participates in the study either for financial reward or for doing a favour for their friends.	• Individuals with a very poor social network have a lower probability of being recruited; • It is difficult to estimate the possible refusals from recruiter. • It is necessary but not easy to check that the person recruited is a member of targeted population, such as checking the needle marks on an injecting drug user. • If the desired sample size is large, recruitment is likely to be difficult for the last waves of interviewees.

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
		number of coupons, and in turn to recruit their peers, until the required sample size is met, and "equilibrium" is achieved. • RDS uses a dual incentive system. Each participant will be compensated for participation in the study and for successful recruitment of eligible participants from their peer network.	• Limited number of recruit can encourage long recruitment chains, and help making a sample to reach into more hidden pockets of the population; • The documented relationship between recruiters and recruits, and the collected information on the personal network size of respondents can be used to adjust for recruitment biases; • Once an "equilibrium" is reached, the sample compositions will be independent of the initial sample (seeds);	

Sampling Techniques	Type of method	Brief procedures	Advantages	Limitations
			RDS does not require an ethnographic assessment to construct sampling frames. It is cheaper, quicker, and easier to implement. The sample compositions will converge to reach equilibrium within a limited number of recruitment waves.	

As aforementioned, we can see that for hard-to-reach populations, non-probability sampling methods such as snowball sampling and facility-based sampling are the easiest to carry out, but are subject to a high risk of sampling bias. The probability sampling methods such as venue-based sampling only includes the population that frequently visits selected venues. As a chain referral sampling technique, respondent-driven sampling (RDS) can be considered a relatively new method since it has own features to overcome some inherent limitations in the other methods. The special recruitment patterns of RDS allows for the calculation of selection probabilities, thus it qualifies as a probability sampling method that can provide an unbiased sample of target hard-to-reach populations.[140] Therefore the RDS technique should be the most appropriate sampling method for this study.

2.8 Methodological issues II: Estimating the size of populations at risk for HIV

Making reliable estimates of the size of high risk populations for HIV transmission is very important for policy making and programming, such as resource allocation, planning, monitoring and evaluation of interventions. A number of various methods for estimating the size of populations at risk for HIV have been well described in the literature.[141-143] All these methods have their own advantages and limitations, which are briefly summarised in Table 9.

Table 9. Summary of main size estimation techniques for populations at risk of HIV

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
Census and enumeration	• Census methods: every individual is counted within a targeted population in a short time period, to avoid a repeated counting produced by migration. • Enumeration methods: a sample is chosen from a sampling frame, and the individuals are counted within this chosen unit. The number counted is then scaled up according to the size and structure of the sampling frame.	• Census and enumeration methods are mathematically straightforward and well-suited for counting at the local level. • Given a good sampling frame, or the population of interest is visible, census methods can be less time-consuming than others and can give better results.	• Census methods are not suitable for hidden populations or areas where populations at risk are scattered. In this case, it is unlikely to field sufficient staff to do the count over a short time period.
Population survey	• It is basically applied to survey the general population, or subsets of the general population by using a representative sample.	• In general, it is easy to construct a sampling frame, and to calculate the representativeness of the	It's not a well suited method for surveying relatively rare behaviours or phenomena existing in the general

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
	• Household survey is the most commonly used form. It starts with a sample of households drawn from a sampling frame which is representative at a national or regional level, and administers questionnaires to residents of this sample.	sample. • Well established methodologies are usually easy to defend, and the result generated from it can be extrapolated to a large area if conducted properly.	population, such as IDUs, because: • Household surveys just select respondents from a sample of households, people engaging in a rare behaviour may not get picked up unless the sample is large enough; • People engaging in high risk behaviours for HIV transmission are usually not in households at all; • People are less likely to tell the truth about their stigmatized behaviours,

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
			especially in the context of their home and family.
Nomination method	• Nomination methods start at the small but visible fraction of hidden population, such as drug users in detention/treatment, or men in bars which are identified as gay's meeting places. • These individuals are reached, and further asked to provide the contacts for others who share their risk behaviours. These referred individuals may then be contacted and asked to provide more peers, etc.	• It's a convenient method to access the hardest to reach populations. • It works best in populations with high levels of interaction between different networks.	• It is hardly to know the representative of the initial "core" group for the whole risk population; • If there is rare mix of distinct sub-groups, this may lead to missing some parts of the population.
Capture-recapture method	A sample of the target population is captured, counted, and tagged once, and then after a period of time, another sample is captured again to get the proportion of tagged people in this sample which can be seen as the representative of the proportion of tagged	This method is suitable for estimating the size of hidden populations.	It is exceedingly rare to meet all criteria for making reliable capture-recapture estimation, especially in hard-to-reach populations.

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
	people in the whole population. Then the total population size can be estimated by using formula: Total = (initial number tagged * total number recaptured) ÷ number tagged on recapture. Use of capture-recapture method must met a number of assumptions listed as follows: • Samples from two captures must be independent with each other, and not correlated; • Each member of the population should have equal chance of being "captured"; • The target population should be "closed" that means no major "in" or "out" immigration happens between these two captures.		
• Network scale-up method	The method rests on the assumption	• It is based on a random sample of the general	• Transmission bias (people may not know everything

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
• (NSUM)	that people's social networks are representative of the general population in which they live and move. The accuracy of the estimate can be improved by combining responses from many respondents as follows: $\hat{e} = \frac{\sum_i m_i}{\sum_i \hat{c}_i} \cdot N$ where ê is the estimated size of the hidden population, m_i is the number of people in the hidden population known by person i, c_i is the estimated personal network size of person i, and N is the size of the general population. N is assumed to be known from sources such as census information, whereas m_i and c_i are determined from data collected in network scale-up survey interviews. "The known population method" and "the summation method" as two indirect methods have been	population and does not require contact with the hidden population to expose their behaviours. • Questions about either the number of people in the hidden population known by a person or that needed to estimate personal network size can be embedded in any existing national survey. • Estimates for the sizes of several hard-to-reach populations can be obtained simultaneously from a single data collection effort.	about members of their personal network) is particularly likely in settings where the behaviour of interest is highly stigmatised. • People may under-report the information in an interview because of the sensitive nature of the behaviours involved. • Social and physical barriers, such as ethnicity, race, occupation and location of residence, may cause variation in the likelihood that respondents know people

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
	used in NSUM studies to estimate personal network size.	• Using "the known population method" to estimate personal network size allows for internal consistency checks, which affords the possibility to improve the accuracy of the estimates.	in hidden populations (barrier effect)
• Multiplier method	Use of the multiplier method requires two independent data sources somewhat overlapping in a known way. The first source, known as "benchmark data" (M), is usually obtained from institutions or services and the second, namely "multiplier data" (P), is usually obtained from a behavioural survey of a target population based on a probability sampling technique. The population size (N)can be	• when the targeted population is hard to reach, or the sampling frame is not available, the multiplier method is a preferable way comparing to census and enumeration methods;	• Finding reliable data from institutions and populations that can correspond with one another is not easy. • The catchment area of selected institution/service is required to be the same

Estimation Techniques	Brief working procedure	Strengths	Weaknesses
	calculated from the formula: N = M / P, that is, multiplying the number of people who attend the institutions or services over a certain period by the inverse of the proportion of the population who report an attendance in these places over the same period. A number of key points should be addressed in using multiplier methods: • First, the definitions of investigated population that overlaps in two data sources must be clear and consistent; • Second, the time reference period in both data sources must be clear and the same; • Third, the age range of the populations to be compared must be similar; • Finally, the catchment area covered by two data sources should be the same.	• If data sources are available and reliable, it is a flexible, straightforward and useful method for population size estimation in many circumstances.	as the survey among target population, which is really difficult to evaluate.

In our study, we used benchmark data from a methadone maintenance treatment (MMT) clinic working in Ruili city while the multiplier was calculated through our cross-sectional survey using RDS technique. We chose the multiplier method because of the following reasons:

- MMT service has been available for IDUs residing in the city for the past 6 years (started since 2005);
- Reliable data which includes information such as admission and attendance was available and obtained;
- Cost–efficiency and simplicity of the multiplier technique
- Our target population (IDUs) was hard to reach.
- RDS technique provided an unbiased sample of target hard-to-reach population, and was eligible as one of reliable data sources for multiplier method.

2.9 A comprehensive review of studies that used RDS among injection drug users in border regions

To learn more about how research studies are carried out to gain insight among IDUs, and how RDS is conducted among this population in practical settings, we reviewed studies that used this method to recruit IDUs in border regions. Literature was searched in PubMed between 1994 and 2013 since RDS is a relatively new sampling method that has been being recognized and adopted by public health researchers since 1994. The full

search terms were (RDS OR respondent driven sampling) AND (IDU OR injection drug user OR injecting drug user) AND (border). Only full text articles documented in English and containing methodological description about RDS were included. Fifteen articles derived from 4 studies were identified. Data relating to research method, with focus on implementation of RDS were systematically extracted and summarized in Table 10 according to different study.

Table 10. Summary of studies that used RDS among injection drug users in border region, 1994-2013

Research Topic	Author/Year	Study Methods	Implementation of RDS
Different effects of migration and deportation on HIV infection among male and female IDUs.[144] High prevalence of latent tuberculosis infection among IDUs.[145] Correlates of methamphetamine use and route of administration by gender.[146]	Strathdee SA, et al. 2008 Garfein RS, et al. 2009 Melanie LR, et al. 2009	**Year/ City / Country:** 2006-2008, Tijuana, Mexico **Study design:** A prospective study of behavioural and contextual factors associated with HIV, syphilis, and TB infection in a cohort of IDUs **Inclusion criteria:** - Being ≥ 18 years old; - Having injected illegal drugs in the past 30 days; - Ability to speak English or Spanish; - Having no plans to permanently move out of Tijuana in the next 18 months (to allow for prospective follow-up). **Sampling method:**	**Recruitment site:** - A mobile office in a modified recreational vehicle - A storefront office **Duration:** 15 months **Seeds:** - 32 "seeds" - Heterogeneous by age, gender and neighborhood **Maximum referrals:** 3 **Primary incentives:** 10 USD for participation in the survey and providing biological sample

Research Topic	Author/Year	Study Methods	Implementation of RDS
Cross-border drug injection relationships among IDUs.[121] Spatial epidemiology of HIV among IDUs.[147] Correlates of injecting in an HIV incidence hotspot among IDUs.[148]	Wagner KD, et al. 2011 Brouwer KC, et al. 2012 Kori N, et al. 2013	RDS for baseline assessment **Sample size:** Desired: not reported; Actual: 1056 IDUs **Interview method:** Computer-assisted personal interviewing (CAPI) by trained local outreach workers **Biological tests:** HIV, syphilis, and TB infection - Pre- and post-test counselling were provided; - Testing positive for syphilis were treated on site; - Testing positive for HIV or TB were referred to the health clinic for free follow-up care. **Ethical consideration:** - Written informed consent;	**Secondary incentives:** 5 USD for successful recruitment of eligible members of their social network **Measurement of social network size:** "In the past 6 months, how many people do you know by name or street name who have injected drugs?" **Average social network size:** Not reported **The greatest number of waves:** Tijuana: 6 waves Cd. Juárez: 8 waves **Equilibrium:** Not reported **Use of weight in data analysis:** Sero-positive prevalence was estimated using RDSAT Data was analyzed separately based on

Research Topic	Author/Year	Study Methods	Implementation of RDS
		− The study was approved by the local ethic boards	respective areas
HIV and syphilis prevalence among IDUs.[149] Shooting gallery attendance among IDUs.[150] Association between syringe possession arrests and receptive syringe sharing.[151] Barriers and missed opportunities to HIV testing.[152]	Frost SDW, et al. 2006 Philbin M, et al. 2008 Pollini RA, et al. 2008 Moyer LB, et al. 2008	**Year/ City / Country:** 2005, Tijuana and Cd. Juárez, Mexico. **Study design:** A cross-sectional study of behavioural and contextual factors associated with HIV and HCV infections **Inclusion criteria:** − Aged 18 years or older; − Having injected illicit drugs in the past 30 days. **Sampling method:** RDS **Sample size:** Desired: approximately 200 per site Actual: 428 IDUs were recruited (222 from Tijuana; 206 from Cd. Juárez)	**Recruitment site:** − Tijuana: A mobile office in a modified recreational vehicle (weekly trips to three diverse neighborhoods in the city; staff from both the municipal HIV/AIDS programme and a NGO that began working with drug users in 1991) − Cd. Juárez: A clinic run by a NGO that has been providing services to and conducting studies with IDUs in the city for decades. **Duration:** 2 months in Tijuana ; 2 weeks in Cd.Juarez **Seeds:** − Tijuana (15 seeds, 207 recruits)
Cross-border paid plasma donation among IDUs.[153]	Volkow P, et al. 2009		

Research Topic	Author/Year	Study Methods	Implementation of RDS
High risk sexual and drug using behaviours among male injectors who have sex with men.[154] The association between deportation history and drug use patterns /accessing care.[120]	Deiss RG, et al. 2008 Brouwer K, et al. 2009	**Interview method:** Interviewer-administered face-to-face interview by trained staff from recruitment centre **Biological tests:** HIV, HCV, HBV and syphilis. - Pre- and post-test counselling were provided; - Testing positive for HIV, HCV and syphilis were referred to the local health clinics for free medical care **Ethical consideration:** - Written informed consent; - The study was approved by the local ethic boards; - All interviews were anonymous.	- Cd. Juárez (9 seeds, 197 recruits) - heterogeneous by age, gender and geographic location **Maximum referrals:** 3 **Primary incentives:** - Tijuana: 25 USD (participation and providing biological sample) - Cd. Juárez: 15 USD **Secondary incentives:** 5 USD: successful recruitment of eligible members **Measurement of social network size:** "In the past 6 months, how many people do you know by name or street name who have injected drugs?" **Average social network size:** Not reported

Research Topic	Author/Year	Study Methods	Implementation of RDS
			The greatest number of waves: Tijuana: 6 waves Cd. Juárez: 8 waves **Equilibrium:** Not reported **Use of weight in data analysis:** − Sero-positive prevalence was estimated using RDSAT − Data was analyzed separately based on respective areas
The prevalence and correlates of HCV infection among young adult IDUs.[155]	Garfein RS, et al. 2013	**Year/ City / Country:** 2009-2010, San Diego, USA **Study design:** A cross-sectional study **Inclusion criteria:** − Being 18–40 years old; − Injected illicit drugs at least once	**Recruitment site:** A study office (not specified) **Duration:** 16 months **Seeds:** Not reported **Maximum referrals:**

Research Topic	Author/Year	Study Methods	Implementation of RDS
		within the previous 6 months; – Were currently residing in San Diego County. **Sampling method:** RDS, facility-based and convenience sampling **Sample size:** Desired: Not reported Actual: 566 IDU participants **Interview method:** Audio computer-assisted self-interviewing (ACASI) technology **Biological tests:** HIV and HCV – Pre- and post-test counselling were provided – Those who tested positive for HIV or HCV were referred for medical	3 **Primary incentives:** Not reported **Secondary incentives:** Participants were given 10 USD for each new recruitment in RDS. **Measurement of social network size:** Not reported **Average social network size:** Not reported **The greatest number of waves:** Not reported **Equilibrium:** Not reported **Use of weight in data analysis:** Not used

Research Topic	Author/Year	Study Methods	Implementation of RDS
		services and care. – All participants were also offered referrals for drug treatment, medical care, and social services. **Ethical consideration:** – Written informed consent; – The study was approved by the University of California San Diego institutional review board. – All interviews were anonymous	
The sero-prevalence of select blood-borne infectious diseases and associated risk behaviours among IDUs.[156]	Baumbach JP, et al. 2008	**Year/ City / Country:** 2005-2006 Cd. Juárez (Mexico) El Paso (Texas, USA) Doña Ana County (New Mexico, USA) **Study design:** A cross-sectional study	**Recruitment site:** – Mexico: an NGO which had achieved longstanding trust in the IDU community – Texas and New Mexico: governmental efforts (not specified) **Duration:** – Cd Juárez (*Mexico*): 2 months – Doña Ana County (*New Mexico*): 3

Research Topic	Author/Year	Study Methods	Implementation of RDS
		Inclusion criteria: – 18 years or older; – English or Spanish speaking; – Having had at least one injection in the past 30 days. **Sampling method:** RDS (In New Mexico, convenience sampling was also used) **Sample size:** Desired: Not reported Actual: 459 IDU participants (204 from Mexico; 155 from Texas; 100 from New Mexico - *83 from RDS*) **Interview method:** Interviewer-administered face-to-face interview by trained study workers **Biological tests:**	months – El Paso (*Texas*): 7 months **Seeds:** – Number of seeds: not reported (*Texas and New Mexico used significantly more seeds than Mexico*) – heterogeneous by age, gender, race/ethnicity and drug of choice **Maximum referrals:** 3 **Primary incentives:** In all three sites: a modest compensation (not specified) for participation and providing biological sample **Secondary incentives:** A modest compensation for successful recruitment of eligible members in Texas and New Mexico, not in Mexico

Research Topic	Author/Year	Study Methods	Implementation of RDS
		HIV, HCV, HBV and syphilis. – Pre- and post-test counselling were provided – Hepatitis A and B vaccines were available for participants at the New Mexico site and Texas site **Ethical consideration:** – Written informed consent; – The study was approved by the Institutional Review Boards of the three respective areas – All interviews were anonymous	**Measurement of social network size:** "How many people do you know by name or street name in the past six months who also shoot up? " **Average social network size:** Mexico: 20 Texas: 14 New Mexico: 10 **The greatest number of waves:** Not reported **Equilibrium:** Not reported **Use of weight in data analysis:** RDS sero-prevalence adjustments were calculated using the RDSAT for the Texas and Mexico data (RDS samples)

From this review, we observed a mixed success of using RDS among IDUs, and substantial methodological heterogeneity among the studies, including interview formats, using single or multi-recruitment site, types of site, numbers of seeds, or different incentive level. Compared to governmental efforts, RDS worked much better with assistance of non-governmental organization, by using trained staff as interviewer and using clinic or drop-in-centre which had achieved longstanding trust in the local IDU community as recruitment centre, which suggests RDS would be more successfully applied after establishing good and trustful working relationships with the IDU population. It also highlights the importance of conducting a formative research at the beginning of RDS, especially in areas where outreach and other services have weak links to the target population, to explore populations' social networking properties, ability and willingness to participate in the study, and other issues such as selecting an appropriate site location and identify appropriate incentives.

We found among IDU populations, the patterns, related risk behaviours, correlates of drug use, mobility and social network, access and utilization of prevention services, prevalence and transmission of infectious diseases varied in different countries, or in different areas in the same country. For designing targeted prevention and intervention programmes, research with IDU population should include components of necessary biological and behavioural monitoring. In this review, all studies used self-reported data collected by different means, and it has been proved sufficiently reliable and valid to

provide natural history and descriptions of drug use and related problems in previous studies.[157] Instead of self-report measure, all studies provided biological test for more than one disease. Providing this function is highly recommended because it not only can provide valid information, but also can provide biological validation of self-reported risk behaviours.

This review also highlighted that when conducting research among IDUs, ethical issues should be fully considered because of inherent social stigmatization and vulnerability in this population. Research staff must take all reasonable precautions to avoid harm to the research participants, including assurance of confidentiality and anonymity, declaration of no any consequences would be caused for valid response, and providing informed consent to ensure that participants are aware of possible implication of participation in the research. In addition, research should not only avoid causing harm, but also attempt to provide real benefits to the research participants, such as combining biological test with provision of corresponding prevention and treatment services. For example, the value of knowing one's HIV status may depend greatly upon follow-up services available after testing.

3. Knowledge gap and rationale

- The increasing use of ATS globally continues to pose significant health and social challenges. Among the various harms attributable to ATS use, the transmission of

HIV has become a growing concern, due to the pharmacological effects of the drug, the high risky sexual behaviours related to drug use, and the potential to share needles/syringes among IDUs.

- As a major transit route for opioid drugs produced in the Golden Triangle, China continues to have a serious heroin use problem. This has been exacerbated by its role as a major producer of crystal methamphetamine, which has led to an upsurge in ATS use. In China, a long established HIV epidemic among IDUs has persisted. While heroin still remains the primary choice by drug users in this country, the use of ATS has increased significantly in recent years. ATS is becoming the most popular drug and has been proven to contribute to the rapid increase in sexual transmission of HIV in China. There are concerns that ATS use among IDUs creates a dual risk for HIV infection due to both injection risk behaviours and risky sexual practices related to drug use. Thus, the severity of problems associated with ATS use among IDUs makes it an important public health issue.

- There are great variations in the extent and patterns of ATS use existing between regions, countries and even within countries. Effective preventions and interventions should be based on a thorough assessment and understanding of the local situation. Although ATS use and associated health and social problems have

been highly reported in previous literature worldwide, little is known about the context of use in China, where established trafficking and manufacturing activities are highly reported. Although some previous studies conducted in China have explored ATS-related problems, nearly all of them only focused on ATS use among drug users who primarily use or are dependent on stimulants, and most studies used convenient sampling technique, which greatly limited the generalisability of research findings to larger populations. In addition, few studies assessed HIV risk behaviour and provided biological results of HIV testing, thus the relationship between specific drug use patterns and HIV infection status has not been evaluated. Until today, research on ATS use, its magnitude and related risks for HIV infection and transmission, especially among injection drug users, is still lacking, and the structural, social, interpersonal, and personal factors that link to ATS use among this high risk population are poorly understood.

- The international border region represents a "unique risk environment where policy, geography, culture, social norms, and disease interact to contribute to health risks".[116] Thus there is an urgent need to target ATS-related problems in such a cross-border area which is located in a major historical heroin trafficking route and is also experiencing a transition from heroin to ATS use, to provide more evidence to guide the development of effective prevention approaches, harm

reduction strategies and specialized services for HIV control in this high risk region.

4. Research questions

- What are the prevalence (including lifetime prevalence and current use, which is defined as having used any ATS within the past 6 months prior to the interview) and patterns of ATS use among these IDUs who live in a cross-border area between China and Myanmar?
- Are there any difference between current ATS-using IDUs and non-current ATS using IDUs on:
  - Social-demographic characteristics
  - Cross-border mobility and social network
  - Drug use experience
  - HIV-related risk behaviours
  - Accessibility/utilization of various prevention and intervention services
  - Sero-prevalence of HIV, HBV, HCV and syphilis
- What are the perceptions and attitudes towards ATS use and related problems among this IDU population? Why these people use ATS?

- What are the prevalence and determinants of HIV and other blood-borne infections among this IDU population?
- How many current active Chinese IDUs (defined as having injected any illicit drugs within the past 6 months prior to the interview) are living in Ruili city?

5. Objectives

5.1 General objectives

This study aims to identify the prevalence, to describe the patterns, and to examine the correlates of methamphetamine use, with regards to demographic, social and mobility-related characteristics, and risks for HIV transmission related to drug use and sexual behaviours amongst current IDUs in Ruili city, China.

5.2 Specific objectives

1. To identify the prevalence and examine the patterns of ATS use among this IDU population.

2. To examine the association between HIV transmission and ATS use.

3. To explore and identify the determinants of current ATS use.

4. To explore the reasons and context of ATS use among this IDU population.

5. To identify the prevalence and correlates of HIV and other blood-borne infections.

6. To estimate the size of Chinese IDUs in Ruili city, Yunnan, China.

7. To recommend appropriate prevention and intervention strategies for health officers and policy makers.

CHAPTER 2

METHODS

1. Conceptual framework

A mixed method research using both quantitative and qualitative approaches was carried out. The methodology is presented in two parts. The first part is for specific objectives 1 to 3 and 5 to 6 by quantitative method. The second part is qualitative approach for specific objective 4. Both parts of this study were carried out in the same study area, namely Ruili city, Yunnan province, China.

Previous studies had indicated that individual, social and environmental factors were associated with ATS use among drug users and other populations. Hereby we undertook this exploratory study to identify the prevalence, to describe the patterns, and to examine the correlates of ATS use, with regards to demographic, social and mobility-related characteristics, and risks for HIV transmission related to drug use and sexual behaviours.

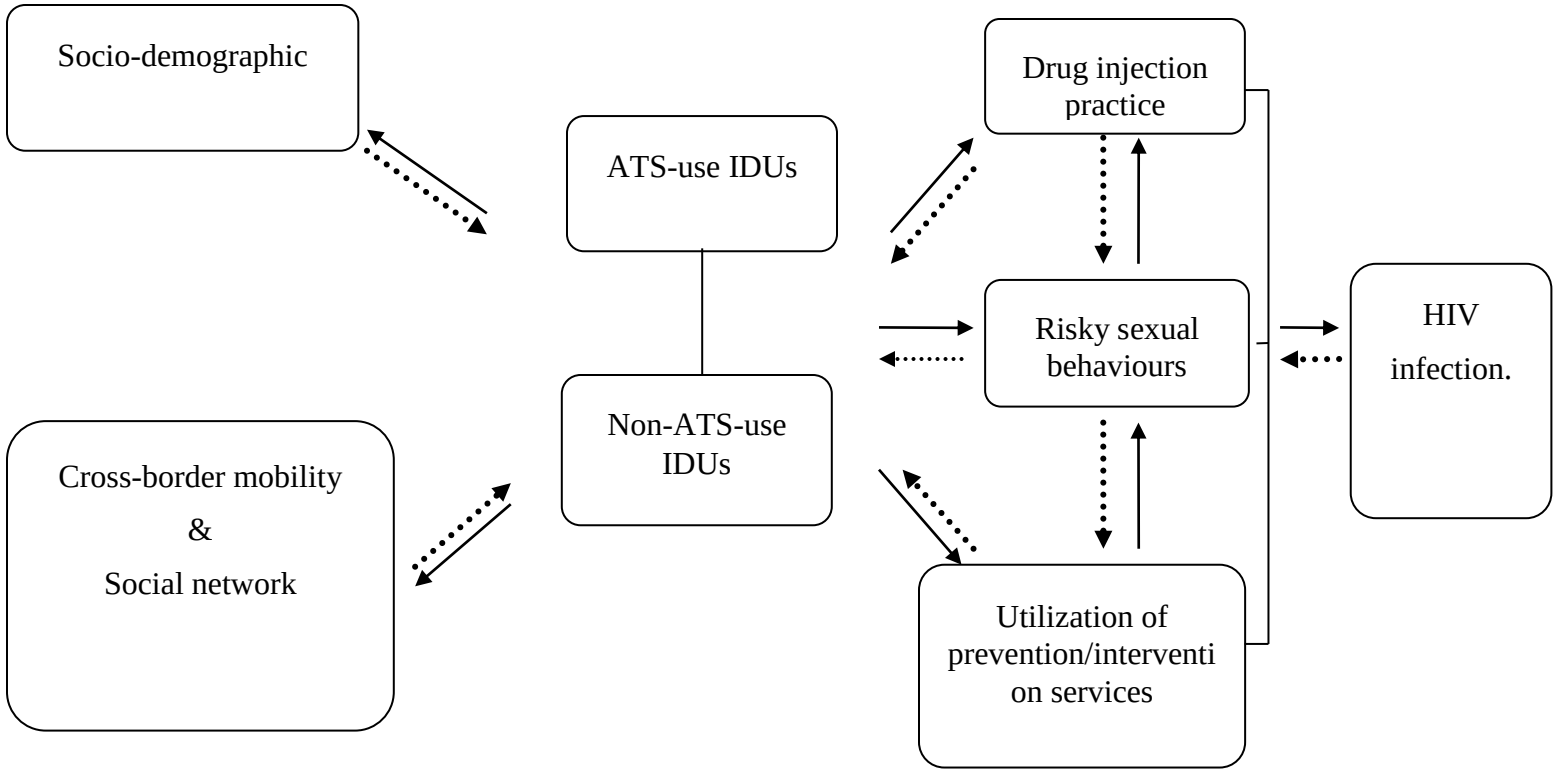


Figure 3. Conceptual framework

2. Methodology Part I: Quantitative approach

2.1 Study design

A cross-sectional behavioural survey (including face to face interviews and serologic testing for HIV, HBV, HCV and syphilis) was conducted.

2.2 Study sample

- ***Inclusion criteria***

1) Chinese IDUs who had injected any illicit drug within the last 6 months before the interview;
2) Aged 18 years or older;
3) Those who had resided in or worked in Ruili city for longer than six months when the study was conducted;
4) Those who presented a valid referral coupon;

- ***Exclusion criteria of a participant***

1) Those who were Burmese or other nationality;
2) Those who used to be an injection drug user, but had not injected any illicit drug within the last 6 months before the interview.
3) Those who were cognitively impaired by drug and/or alcohol use at the time of interview.

2.3 Sampling method

Respondent-Driven Sampling (RDS) technique was employed to recruit the study participants. The details about this method are covered in “Data collection procedure” and attached manuscripts.

2.3.1 Sample size calculation

To estimate the extent of ATS use among current active IDUs, the sample size was calculated based on an estimation of proportion formula. Since our target population (IDUs) is a relatively small proportion of the total population and the number of people is finite, thus we used the formula with finite population correction as follows:

$$n = \frac{NZ^2P(1-P)(deff)}{d^2(N-1)+Z^2P(1-P)}$$

where

n = sample size with finite population correction,

N = population size (1200)

Z = Z statistic for a level of confidence (1.96)

P = expected prevalence (0.5)

d = precision (0.1).

deff = *d*esign effect (2)

We assumed that there were about 1200 active IDUs living in Ruili city. In order to get enough sample size, we chose 0.5 for estimated prevalence of ATS use. We

assumed a design effect of 2 for RDS, with a precision of ± 10%, type I error is at 5%, a sample size of 178 was required.

For hypothesis testing, we hypothesized that the HIV prevalence among IDUs who were also current ATS users (which was defined as having used any ATS within the last 6 months before the interview) would be higher than that among non current ATS users. From literature review,[47, 48] we assumed the HIV prevalence among non-current ATS users was 38% (p2). In order to have an odds ratio of two which would be practically important, the HIV prevalence among current ATS-use IDUs was assumed to be 55%. The sample size required for detecting this difference was obtained from the formula for comparison of two proportions as follows:

$$n_1 = \frac{\left[Z_{1-\alpha/2}\sqrt{p(1-p)(1+1/r)} + Z_{\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)/r} \right]^2}{\Delta^2}$$

where

p_1 = prevalence of HIV among ATS users

p_2 = prevalence of HIV among non-current ATS users

r = ratio of the samples in the two groups (n2/n1=1)

$\Delta = p_1 - p_2 = 0.17$

$P = (p_1 + p_2)/2$

α = Type I error = 0.05

β = Type II error = 0.2

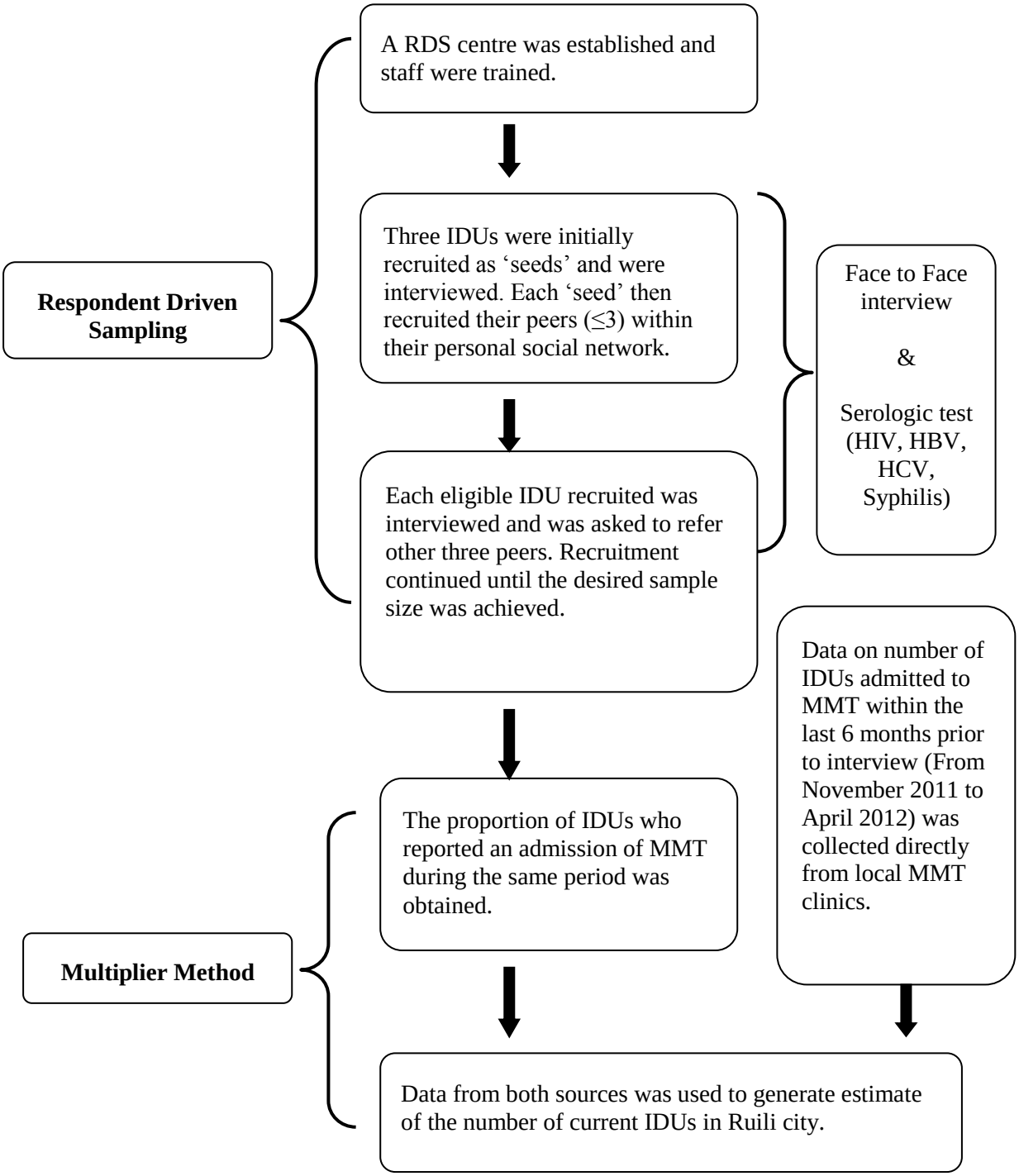
Z_β = standard normal deviate for given β

The required sample size was determined to be 145 in each group. Taking into account a 20% of non-response rate, the estimated sample size was increased to 181 in each group. Hence, the total sample size required was 362.

2.4 Data collection procedure

The main steps involved in data collection procedure are shown in the following diagram.

Figure 4. Data collection procedure



1) Recruitment of participants using Respondent Driven Sampling

Based on recommendations obtained from a prior meeting with local public health staff and outreach workers, a RDS recruitment centre was established in a drop-in centre of a needle-syringe exchange programme (NSP) run by HIV/AIDS Asia Regional Program (HAARP) Yunnan Management Office and local government. One female and two male IDUs of three different age-groups (≤25, 26-35 and >35 years) and three ethnic groups (Han, Jingpo and Dai) were selected as "seeds" of the RDS chain (3 seeds in total). Each seed was given three uniquely coded coupons (Annex-1), which was valid for 30 days to recruit his/her peers. An instruction was also given to the recruiter to guide him/her how to recruit their eligible peers (Annex-2). Individuals who could present a valid coupon before the expiry date and who were eligible for this study were enrolled, and were given up to three recruitment coupons to recruit their peers. The recruitment process continued until the desired sample size and equilibrium with respect to the main variables being measured was achieved.

2) Interview of respondents

The participants were initially screened for eligibility of this study by inspecting their "track-marks" and asking them some questions (Annex-3). After giving written informed consent (Annex-4), participants were interviewed using a structured questionnaire (Annex-5). All interviews were conducted by the principle researcher of this study and two well-trained indigenous outreach workers of the NSP drop-in

centre. Participants were compensated with 50 Chinese Yuan (about 8 US dollars) for their participation in the study and an additional 20 Chinese Yuan (about 3 US dollars) for successful recruitment of each eligible participant from their peer network.

3) Serologic testing

Enrolled participants were asked to provide a blood sample for serologic testing. Each participant provided 7 ml intravenous blood for serological testing of HIV, hepatitis C virus (HCV), syphilis antibody and hepatitis B virus (HBV) surface antigen (HBsAg). All samples were sent to a laboratory of the Centre for Disease Control and Prevention (CDC) in Ruili city for initial testing.

HIV screening was conducted using two enzyme-linked immunoassays (ELISAs; Livzon Group Reagent Factory, Zhuhai, China). If both tests were reactive, a western blot test (WB test; Genelabs Diagnostics Pte Ltd., Singapore) was conducted for confirmation at HIV Confirmatory Laboratory in CDC of Dehong Dai and Jingpo Autonomous Prefecture. The sample was considered HIV positive when both the ELISA and WB tests were positive. The presence of HBsAg and anti-HCV antibody was detected by ELISA (ELISA; Beijing Wantai Biologic Production Co. Ltd, Beijing, China). Syphilis screening was performed by rapid plasma regain (RPR; Beijing Wantai Biologic Production Co. Ltd, Beijing, China). Specimens testing positive for syphilis antibody were confirmed by the treponema pallidum particle

agglutination test (TPPA; Livzon Group Reagent Factory, Zhuhai, China), with titer ≥1:8 being considered as current infection and otherwise past infection.

Serological specimens and testing results were anonymous and were only linked to the survey data by a unique coupon number. All participants were asked to return or make a phone call after three weeks to obtain their results by providing both the unique coupon number and their date of birth. Pre-test counselling was provided to all participants, while post-test counselling and referrals were provided to those who were serologically positive.

4) Estimation of IDU population size using multiplier method

The population size of current IDU was calculated from the formula:

$$N = M / P$$

where: N is the size of population being estimated, M is the benchmark data which was the number of newly admitted IDUs (including new admissions and readmissions) in the past six months prior to the RDS survey (from November 2011 to April 2012) in the MMT clinic in Ruili city, P is the proportion of IDUs who reported an admission of MMT during the same period from our RDS survey.

2.5 Main study variables

1) Socio-demographic variables:

Socio-demographic variables included age, gender, ethnicity, marital status, education level, employment status, occupation, income level, and residential status.

2) Drug use history

ATS use

- Lifetime experience of ATS use
- Age of first use
- Motivation for initiation and continuing use
- Frequency of use in the last 6 months
- Route of administration in the last 6 months
- Dosage of use in the last 6 months
- Reasons of ATS use in the last 6 months
- Source of acquisition, locations and companions of use in the last 6 months
- Influence of ATS use on sexual desire/performance in the last 6 months
- Frequency of use in past 30 days

Use of other substances (alcohol, heroin, opium, benzodiazepines, marihuana, ketamine, Demerol® and cocaine)

- Lifetime experience of use
- Age of first use

- Frequency of use in the last 6 months
- Route of administration for each drug used in the last 6 months

3) Drug injection practice

- Initial age of injecting drug
- Frequency of injection drug use in the last 6 months
- History of needles/syringes sharing in lifetime and in the last 6 months
- History of sharing other injection equipment and reusing previously used needles/syringes in the last 6 months

4) Sexual behaviours

- Age at sexual debut
- Number of sexual partners in lifetime and in the last 6 months
- Frequency of sexual intercourse and condom use practice with different types of partners during the last 6 months
- Condom use practice in the most recent sexual intercourse
- Experience of engaging in sex under the influence of any drugs in the past 6 months
- Experience of participating in commercial sex

5) Cross-border mobility and social network related characteristics

- History of travel to Myanmar in lifetime and in the last 6 months
- Reasons of travelling to Myanmar in the last 6 months
- Cross-border drug use and injection behaviour
- Number of known drug users and if having contact with Burmese drug users

6) Utilization of prevention/intervention services in lifetime and in the past 6 months

- This was measured by 11 yes-no questions including HIV counselling/testing; education services for HIV/AIDS, STI, relapse coping skills, safe injection, harm of methamphetamine and other new-type drugs, and skills of proper condom use; psychological counselling and guidance; free condom distribution; NSP and MMT programme.

7) Number of times incarcerated in lifetime.

8) Sero-prevalence of HIV, HBV, HCV and syphilis from laboratory test.

2.6 Data management and analysis

1) Data was double entered into EpiData software (version 3.1). All databases and blood specimens were linked by coupon ID number.

2) For adjusting potential bias arising from RDS due to respondents' different personal social network size and homophily of recruitment, RDSAT (Respondent-Driven Sampling Analysis Tool, version 5.6.0;

www.respondentdrivensampling.org), which is specifically designed to analyze data collected through RDS, was used for descriptive analyses (giving adjusted point estimates and 95% confidence intervals) and to calculate sampling weights for all univariate and multivariate analyses.

3) Descriptive component: mean/median for continuous/discrete variables and percentage for categorical variables were presented.

4) Analytical component: univariate and multivariate logistic regressions were performed to identify factors associated with HIV, HCV infections and current methamphetamine use, using survey design-based methods using the R language and environment (version 2.13.0). Independent variables associated with the outcome at p-value<0.10 in univariate analysis were considered for inclusion in initial multivariable model and further refinement of the model was done by a backward elimination procedure. At each step, the variable with the largest p-value from the Rao-Scott likelihood ratio test was removed until all variables remaining in the final model had p-value< 0.05.

3. Methodology Part II: Qualitat*ive* approach

3.1 Study design

In-depth interviews were conducted following an interview guideline (Annex-6). The purpose of the in-depth interview was to obtain narrative information regarding the perceptions and attitudes towards ATS use, as well as reasons and context of use.

3.2 Study sample

All participants must be current IDUs and ATS users which were defined as an individual who had injected any illicit drug and ever used ATS within the last six months before the interview. Other inclusion criteria for this qualitative study included: being 18 years or older, being Chinese, and having resided in or worked in Ruili for longer than six months.

In order to better understand diversity and variability of experience in samples, a balanced number of male and female participants with different patterns of ATS use (regular user vs occasional user) were recruited. A regular user was defined as an individual who had been using ATS at least three times a week during the last six months prior to the interview while an occasional user was one who used ATS less frequently.

3.3 Sampling method

Samples were purposively selected by two methods based on the attributes required as follows.

1) Current IDUs who were good at oral expression, and showed high knowledge about local drug scene during the quantitative interview were selected as eligible candidates for in-depth interview by the principle investigator (LL).

2) Potential participants were found by outreach workers of NSP and informally screened for eligibility by LL among those who were willing to attend this study.

The selection process was carried out consecutively until the information was saturated.

3.4 Sample size

The number of subjects needed was determined upon the saturation of the data, however, at least 12 participants were required as shown in Table 11.

Table 11. The required number of participants for in-depth interview

Subgroups	Number of participants
– Male IDU who were regular ATS users	3
– Female IDU who were regular ATS users	3
– Male IDU who were occasional ATS users	3
– Female IDU who were occasional ATS users	3

3.5 Data collection procedure

All interviews were conducted in the NSP drop-in centre by the principle investigator of this study. The topics covered in the interview guideline mainly included the availability of drugs, the extent of drug use in local society, knowledge and perceptions about ATS use and motivations of ATS use.

Written informed consent (Annex-4) was obtained before interview. Interviews lasted between 45 and 90 minutes and were audio recorded with prior permission of the participants. Each participant was compensated with 100 Chinese Yuan (about 16 US dollars) for their time.

3.6 Qualitative data analysis

After fully transcribing the interviews, content analysis was used to identify the major and sub-themes with respect to the topics covered by the interview guideline. Qualitative content analysis is a systematic method which is useful when analyzing an individual's or a group's experiences, reflections and attitudes.[158] The transcripts were initially hand-coded according to pre-established general themes. The reorganized data from the initial coding was then reviewed to identify new themes and sub-themes to further refine the coding process. Meaningful quotes were extracted from the transcripts to illustrate particular findings and also give some interpretations.

4. Ethical consideration

This study was approved by the Human Studies Committee of Yunnan Institute of Drug Abuse (YIDA), China (Annex-7) and the Ethics Committee of the Faculty of Medicine, Prince of Songkla University, Thailand (Annex-8).

Written informed consent (Annex-4) was obtained in a voluntary and confidential manner before interview. Participants could refuse to answer any questions without any consequences or ask for additional explanations if any. All information collected was kept strictly confidential and was used for research purposes only. All data were recorded and analyzed anonymously.

CHAPTER 3

RESULTS

The findings of this study are divided into three parts with respect to different methodologies and main findings.

1. Part I: Risk behaviours, prevalence of HIV/HCV, and population size of current injection drug users

A total of 370 eligible participants were recruited after 11 waves. Equilibrium was achieved by wave 7 with regard to some key variables such as gender, age, ethnicity, marital status, education level, occupation, residential status, ATS use status, and infection rates of HIV, HBV, HCV and syphilis. The median number of injection drug users known by these participants, namely network size was 6. (Range: 1-25; IQR: 4-10)

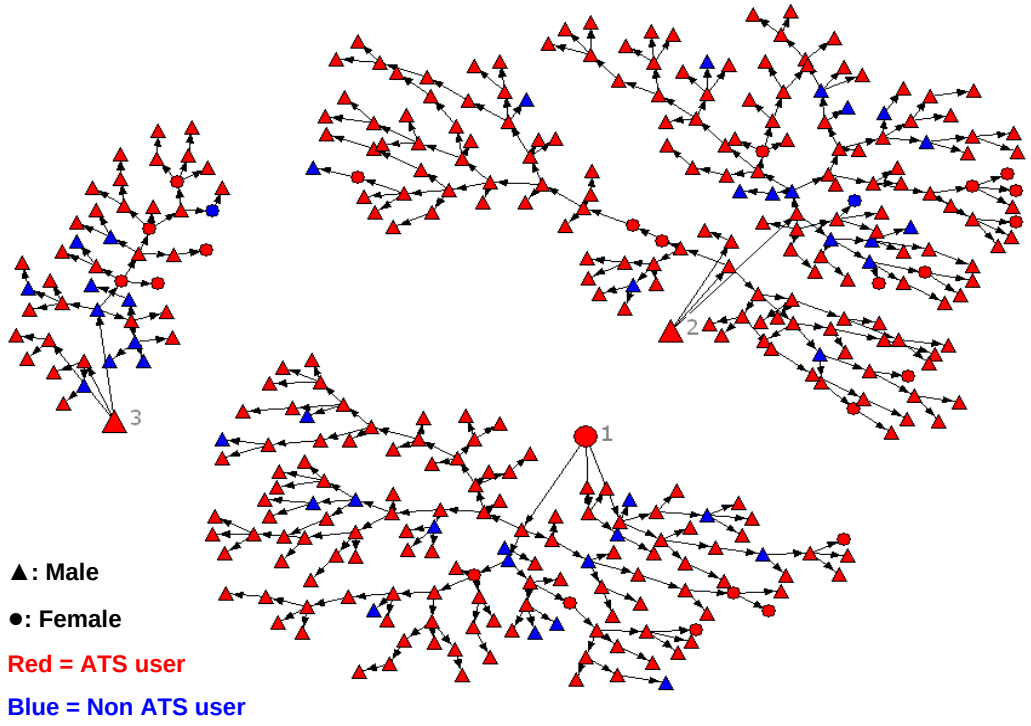


Figure 5. Diagram of RDS sampling procedure among current IDUs (n=370) in Ruili, 2012

1.1 Social-demographic characteristics of IDUs and prevalence of HIV / HBV / HCV /syphilis

Almost all participants were males and the mean age was 36.2 years (SD=9.4). Most were local residents of Ruili with more than half being from an ethnic minority such as Jingpo and Dai. Over one-third were single and most had less than junior high school education. Most participants were employed with one-third each working as a

farmer or casual laborer. Almost 80% reported having a history of incarceration in their lifetime. (Table 12)

Table 12. Social-demographic characteristics and prevalence of HIV/ HBV/ HCV /syphilis

	Weighted %	95%CI
Age		
≤25 years	13.6	(9.6-17.9)
26～35 years	36.7	(30.9-42.4)
＞35 years	49.7	(43.7-56.1)
Male	92.7	(89.3-95.8)
Ethnicity		
Han	45.7	(37.2-53.2)
Others	54.3	(46.8-62.9)
Marital status		
Single	38.4	(32.6-43.8)
Living with a spouse or partner	35.5	(30.2-41.4)
Divorced/separated/widowed	26.1	(21.7-30.9)
Education		
Primary school and below	49.3	(43.2-55.5)
Junior high school	38.9	(32.9-44.9)
Senior high school and above	11.8	(8.7-15.5)
Occupation		
Casual labourer	34.3	(29.2-41.5)

Farmer	38.3	(30.4-45.6)
Others	11.7	(8.5-14.8)
Unemployed	15.6	(11.6-19.0)
Monthly income ≤1500 RMB	65.5	(60.7-70.7)
Residential status		
Local resident	84.9	(80.9-88.4)
Non-local	15.1	(11.6-19.1)
Having a history of incarceration	78.3	(73.3-83.3)
HIV positive	18.3	(14.1-22.8)
HBV positive	9.8	(6.1-13.4)
HCV positive	41.5	(35.9-47.4)
Syphilis positive	7.8	(5.2-10.0)

1.2 Drug use history

The mean age at first use of any substances (excluding alcohol) was 23.3 (SD=3.7) years, with up to 26.4% starting before the age of 18 years. Heroin, alcohol and ATS were the three most prevalent substances used by participants in their lifetime. Use of other substances included opium, benzodiazepines, marijuana, ketamine, Demerol® and cocaine. About 70% of the respondents had used at least three kinds of substances in their lifetime with a range of 2-8 kinds (median = 4, inter-quartile range (IQR) = 3,

5). In the past 6 months, besides heroin, the most frequently used drug was ATS, followed by alcohol, benzodiazepines and opium. (Table 13)

Table 13. Types of drug used in lifetime and the past six months

	Lifetime use		**Current use**	
Drug type	**Weighted %**	**95%CI**	**Weighted %**	**95%CI**
Heroin	100	-	100	-
Alcohol	95.5	(93.6-97.3)	60.1	(54.0-66.1)
Amphetamine-type stimulants (ATS)	84.2	(79.9-89.3)	75.2	(70.0-81.1)
Opium	60.7	(54.8-66.9)	9.3	(5.7-13.3)
Tranquilizers/barbiturates/benzodiazepines	35.4	(30.4-40.6)	22.1	(18.5-26.2)
Other drugs (marijuana, ketamine, Demerol®, cocaine)	12.2	(8.5-16.3)	3.2	(1.3-5.7)

1.3 Injection behaviours

The mean age at first use of injection drugs was 28.9 years (SD=8.8) with 8.4% starting before the age of 18 years. Almost half (45.8%) had injected drugs for more than five years (mean 7.2 years, SD 6.4). Heroin, diazepam and Demerol® were the most common drugs injected by IDUs in their lifetime (100%, 34.2% and 3.9%, respectively). Of all, 36.1% had injected more than one type of drugs and 27.1% and

62.3% had shared needles/syringes and other injection equipment such as bottles, spoons, cotton, filters, solution or rinsing water from a shared container with others in their lifetime.

In the past six months, 77% of participants reported injecting drugs daily while the rest did so monthly or weekly. The most common drugs of use for current IDUs were heroin (100%), diazepam (21.8%) and Demerol® (2.1%). Receptive needle/syringe sharing accounted for 9.6%, distributive sharing 12.3% and other equipment sharing 34.1% of all IDUs. 62% reported ever injecting with a previously self-used needle or syringe.

1.4 Sexual risk behaviours

Nearly all participants (99.2%) reported having a sexual encounter in their lifetime. Amongst them, the mean age at sexual debut was 18.9 years (SD=3.2), and 53.1% were sexually active before 18 years of age. The majority (83.5 %) reported having two or more sex partners in their lifetime.

In the previous six months, 51.7% of the participants reported having had sexual intercourse, and 17.6% had had more than one partner. Of these, 82% had sex with a regular partner in the past six months and 93.2% of them reported having unprotected sex with this type of partner. Having sex with non-regular partners was reported by 33.6% of respondents and among these 69.6% reported inconsistent condom use with

these partners. 28% of those who had ever had sex used a condom during their last sexual episode.

Having sexual behaviours when high on drugs was reported by 57.0% of participants who had sex in the past six months. Experience of drugs–for-sex was reported by 2.4% of participants.

1.5 Utilization of prevention services

Half (49.3%) of the participants reported having received more than six types of prevention services during their lifetime with 53.4% reporting using any of these services in the past 6 months. Lifetime utilization of NSP and MMT was reported by 32.0% and 11.4% of participants, respectively while 28% and 3.5% reported having used NSP and MMT services in the past six months.

1.6 Factors associated with HIV status

In the adjusted univariate analysis, variables marginally associated with the outcome variable of HIV sero-status ($p<0.10$) included age-group, HCV and syphilis infection, history of incarceration, duration of drug injection, number of drugs injected, needle/syringe sharing and reusing in lifetime and past six months, and frequency of injection and condom use with non-regular partners (Table 14). In the multivariate analysis, HCV infection, having a history of injection drug use more than five years and having experience of sharing needles and syringes with others during their

lifetime were independently and significantly associated with being HIV positive. (Table 15)

1.7 Factors associated with HCV infection

Variables associated with HCV infection in the univariate analysis included HIV status, history of incarceration, duration of injection drug use, numbers of drugs used, needle/syringe and other equipment sharing in lifetime and past six months, reusing needle/syringe, frequency of injection and condom use with regular partner (Table 14). Four variables were found to be independently associated with HCV infection in the final model, namely HIV infection, having injected more than one type of drug during lifetime, having shared other injection equipments in the past and having unprotected sex with regular sex partner within the past six months. (Table 15)

1.8 Estimated IDU population size

Our RDS survey revealed that the proportion of those who reported having an admission in the MMT clinic between November 2011 and April 2012 was 2.8% (95%CI: 1.3-4.7%). The number of IDUs who were newly admitted or re-admitted in the MMT clinic during the same time period was 76, thus the total number of IDUs based on this data source was estimated to be 2714 (95%CI: 1617-5846). Based on the census data in 2011, the total population of Ruili City was 181,239 (including unregistered citizens), the prevalence of IDUs was thus estimated to be 2714/181,239 = 1.50% (range 0.89%-3.23%).

Table 14. Factors associated with HIV and HCV infections in univariate analysis

	HIV positive			HCV positive		
	weighted%	**OR**	**(95%CI)**	**weighted%**	**OR**	**(95%CI)**
Age						
≤25 years	6.4	1		30.3	1	
26～35 years	23.4	1.19	(1.05-1.35)	48.0	1.19	(0.97-1.45)
＞35 years	17.8	1.13	(1.02-1.25)	40.0	1.12	(0.93-1.35)
Having a history of incarceration						
No	6.0	1		30.8	1	
Yes	21.8	1.17	(1.08-1.27)	44.5	1.16	(0.99-1.34)
HIV status						
Negative	_			32.3	1	
Positive				83.6	1.67	(1.42-1.95)
HCV status						

	HIV positive			HCV positive		
	weighted%	**OR**	**(95%CI)**	**weighted%**	**OR**	**(95%CI)**
Negative	5.2	1		_		
Positive	37.1	1.37	(1.23-1.52)			
Syphilis status						
Negative	17.4	1		41.0	1	
Positive	34.3	1.21	(0.99-1.48)	54.7	1.13	(0.92-1.40)
Duration of injection drug use						
≤5	5.7	1		33.8	1	
＞5	32.1	1.14	(1.04-1.24)	51.0	1.2	(1.05-1.36)
Number of drugs injected						
1	12.3	1		34.6	1	
≥2	28.2	1.17	(1.05-1.30)	53.2	1.21	(1.06-1.37)

	HIV positive			HCV positive		
	weighted%	**OR**	**(95%CI)**	**weighted%**	**OR**	**(95%CI)**
Sharing needle/syringe						
No	7.4	1		36.5	1	
Yes	47.5	1.5	(1.31-1.71)	53.5	1.22	(1.05-1.42)
Sharing other injection equipment						
No	14.8	1		30.6	1	
Yes	21.0	1.07	(0.97-1.18)	47.7	1.19	(1.05-1.35)
Frequency of injection drug use [a]						
Monthly/weekly	8.8	1		29.4	1	
Daily	20.3	1.12	(1.01-1.23)	43.9	1.17	(1.01-1.36)
Receptive needle/syringe sharing [a]						
No	15.3	1		38.3	1	
Yes	47.5	1.39	(1.17-1.66)	74.2	1.43	(1.22-1.66)

	HIV positive			HCV positive		
	weighted%	**OR**	**(95%CI)**	**weighted%**	**OR**	**(95%CI)**
Injection with a previously self-used needle/syringe [a]						
No	8.6	1		32.2	1	
Yes	24.4	1.17	(1.07-1.28)	46.8	1.18	(1.03-1.35)
Having unprotected sex with regular sex partner [a]						
No	19.4	1		10.0	1	
Yes	12.1	0.93	(0.74-1.18)	40.8	1.42	(1.24-1.63)
Having unprotected sex with non-regular sex partner [a]						
No	8.2	1		33.2	1	
Yes	18.9	1.31	(1.05-1.64)	52.1	1.17	(0.85-1.62)

[a] Past 6 months [b] $p<0.1$ [c] $p<0.05$ OR: odds ratio CI: confidence interval

Table 15. Final model showing association of factors with HIV and HCV sero-prevalence

	AOR	(95%CI)	P value
HIV infection			
HCV positive	1.29	(1.17-1.43)	＜0.001
Duration of injection drug use ＞5 years (ref.≤5)	1.25	(1.13-1.39)	＜0.001
Shared needle/syringe (lifetime)	1.45	(1.27-1.65)	＜0.001
HCV infection			
HIV positive	1.59	(1.36-1.87)	＜0.001
Number of drug types injected ≥2 (lifetime)(ref.1)	1.14	(1.01-1.29)	＜0.05
Shared other injection equipment (lifetime)	1.15	(1.03-1.30)	＜0.05
Had unprotected sex with regular sex partner (past six months)	1.44	(1.23-1.68)	＜0.001

AOR: adjusted odds ratio

2. Part II: Cross-border activities and association with current methamphetamine use

Methamphetamine pill was the most commonly used ATS reported by the participants. Among 326 participants (84.2%) who reported a lifetime history of ATS use, all used methamphetamine pill and 293 (75.2%) had used it within the previous 6 months. Only 28 (3.3%) had an experience of using “ice” (crystalline methamphetamine) and 16 (1.6%) had an experience of ecstasy use during their lifetime.

2.1 Patterns of methamphetamine use

Of 326 participants who ever used methamphetamine in their lifetime, the average age at onset was 28.6 years (SD = 9.7 years), with 8.9% having their first use in Myanmar. The majority of participants experienced their first use with their friends (82.9%) and 59.6% did not pay for it. The top five reasons for starting to use methamphetamine were: to experiment (84.6%), to get high (27.0%), to get more energy (26.5%), peer pressure (18.6%), and to relax (12.8%). (Table 16)

Table 16. Initial use of methamphetamine (N=326)

	n	Weighted%	(95%CI)
Main reasons for initial use			
To experiment	281	84.6	(80.5-88.6)
To get high	95	27.0	(21.5-31.8)
To get more energy	90	26.5	(21.5-31.3)
Peer pressure	47	18.6	(14.1-23.7)
To relax	48	12.8	(9.2-16.7)
To relieve boredom	30	6.7	(4.6-9.4)
Partners of the first use			
Alone	50	15.8	(11.7-21.2)
Friends	269	82.9	(77.3-87.0)
Spouses/girlfriends or boyfriends	8	2.3	(0.7-3.9)
Other family members	12	3.6	(1.9-5.5)
Drug dealers	11	2.9	(1.4-4.7)

Among 293 current methamphetamine users, 25.4% used methamphetamines daily, and 92.4% reported taking at least two pills in a typical using day. The main reasons for using methamphetamines changed over time, with enhancing sexual performance (31.3%) becoming a more common reason for current use, compared to initial use. Most participants used methamphetamines at their own place (57.6%) or a friend's house (52.0%), and usually used it with friends (72.4%). They usually purchased

methamphetamines from drug dealers (98.2%), with one fifth reporting ever purchased methamphetamine from Myanmar for a lower price or better quality while 8.9% reported using it there during the past 6 months. (Table 17)

Table 17. Patterns of current methamphetamine use (N=293)

	n	Weighted%	(95%CI)
Main reasons for use			
To get more energy	165	54.5	(48.2-60.1)
To relieve boredom	121	40.7	(33.9-47.1)
To relax	113	35.7	(30.5-41.5)
To enhance sex	86	31.3	(24.6-38.5)
Being addictive	81	26.9	(21.4-32.6)
To get high	80	24.1	(18.9-29.3)
Frequency of use			
1-3 days / month	98	36.2	(30.9-42.2)
1-6 days / week	119	38.4	(32.2-44.5)
Daily	76	25.4	(19.3-31.0)
Location of use			
One's own home	170	57.6	(52.0-63.3)
Another's home	152	52.0	(45.7-59.4)
Outdoors	147	47.4	(40.2-54.6)
Night club or hotel	9	5.9	(2.5-9.3)
Main source of acquisition			

	n	Weighted%	(95%CI)
From drug dealers	284	98.2	(97.0-99.3)
From friends without payment	84	25.3	(20.0-30.9)
By trading sex	1	0.3	(0.2-0.9)
Partner of use			
Alone	66	24.4	(18.3-30.6)
Friends	220	72.4	(65.6-78.7)
Spouses/girlfriends or boyfriends	22	8.9	(5.2-12.9)
Other family	9	3.1	(1.5-5.1)
Drug dealers	21	6.1	(3.8-9.0)
Location of drug purchase			
China	247	81.9	(76.8-87.2)
Myanmar	8	5.0	(1.3-9.2)
Both	38	13.1	(9.1-17.0)
Reason for purchasing drug from Myanmar(n=46)			
Lower price	36	83.6	(70.0-92.9)
Better quality	33	79.1	(64.5-89.9)
Easier to get	28	65.6	(46.4-79.4)
Safer	10	20.9	(7.1-36.5)

Among current methamphetamine users, 34.3% reported having sexual behaviours while under the influence of the drug, and 40.2% perceived that methamphetamine

use enhanced their sexual performance, although some of them did not use it purposively for sex. During the past 30 days, methamphetamines were used on average 13.7 days (SD=11.2). Some participants reported ever using methamphetamines in combination with other drugs, including heroin (10.9%), benzodiazepines (0.7%), and a mixture of them (1.0%). In terms of route of administration, smoking and snorting were the only ways reported by all users both on initial and subsequent use.

2.2 Cross-border associated activities and social network

Most IDUs (90.7%) ever travelled to Myanmar, while 34.3%, 23.6% and 6.5% reported ever using illicit drugs, injecting drugs and sharing needles and syringes there, respectively. Within the last 6 months, 120 (32.1%) participants reported travelling to Myanmar at least once and 53 (14.2%) reported using illicit drug(s) there. Furthermore, 9.5% reported injecting drugs in Myanmar, with half of them (51.4%) sharing needles and syringes when they stayed there. Reasons for crossing the China/Myanmar border included purchasing drugs (28.0%), visiting family/friends, doing business or odd jobs (10.8%), and avoiding capture by police (2.6%).

The median number of drug users known by these participants was 8 (inter quartile range: 5, 15), and nearly one fourth (25.2%) knew more than 10 people. Of these participants, 29% reported having connections with Burmese drug users within the past 6 months.

2.3 Factors associated with current methamphetamine use

Table 18 shows variables which were associated with current methamphetamine use at $p \leq .10$, obtained from univariate analysis in five domains. These variables were thus entered into the multivariate logistic regression model for further analysis.

After elimination of non-significant contributors, six variables remained in the final model, namely age, syphilis status, history of using previously self-used needle/syringe, receiving prevention services, purchasing drugs in Myanmar, and crossing border to Myanmar for work or visiting family/friends. Compared to non-current methamphetamine users, the current users were more likely to be younger (aged ≤ 25 years; AOR=1.24, 95%CI: 1.09-1.41), be syphilis positive (AOR=1.17, 95%CI: 1.03-1.33), use previously self-used needles/syringes (AOR=1.20, 95%CI: 1.08-1.34) and receive prevention services in the past six months (AOR=1.15, 95%CI: 1.04-1.28). IDUs who had cross-border activities, including purchasing drugs in Myanmar and visiting family/friends or doing business or odd jobs in Myanmar, were 1.13-1.20 times more likely to use methamphetamines in the past six months, compared to those who did not have these activities, after controlling for other variables in the model (AOR=1.20, 95%CI: 1.10-1.31; AOR=1.13, 95%CI: 1.02-1.24, respectively). There was no association between methamphetamine use and HIV sero-positivity observed among this IDU group. (Table 19)

Table 18. Factors associated with current methamphetamine use in univariate analysis (N=370)

	Current user (N=293) Weighted% (95%CI)	Non-current user (N=77) Weighted% (95%CI)	OR(95%CI)	P value
Demographics and other information				
Age≤25yr (vs.＞35)	16.8 (12.0-22.1)	4.3 (1.0-8.3)	1.19 (1.04-1.36)	＜0.001
Other ethnic minorities (vs. Han)	57.5 (49.9-65.9)	43.5 (28.4-57.8)	1.13 (1.00-1.27)	0.05
Monthly income＞1500(Chinese Yuan)	31.6 (26.1-37.1)	44.4 (31.5-56.3)	0.90 (0.79-1.02)	0.09
History of incarceration	82.4 (77.6-86.7)	66.6 (54.9-80.5)	1.19 (1.01-1.41)	0.04
Received prevention services *	59.6 (53.6-66.6)	34.9 (23.6-47.3)	1.20 (1.06-1.36)	＜0.01
Social network size＞10 *	28.1 (22.6-34.0)	16.9 (9.6-26.3)	1.12 (1.00-1.27)	0.05
Ever socialized with Burmese drug users *	31.6 (25.9-37.8)	20.1 (12.0-30.2)	1.11 (1.00-1.25)	0.05
HIV positive	20.4 (15.4-25.4)	12.5 (6.8-20.4)	1.11 (0.98-1.25)	0.10

	Current user (N=293) Weighted% (95%CI)	Non-current user (N=77) Weighted% (95%CI)	OR(95%CI)	P value
Syphilis positive	8.8 (6.0-12.0)	3.4 (1.1-7.0)	1.17 (1.02-1.34)	0.03
Substance use history				
Age of initial substances use ≤18 years	31.1 (25.9-37.0)	13.1 (7.8-20.5)	1.19 (1.08-1.31)	＜0.001
Used other drugs (marihuana, ketamine, cocaine) *	3.4 (0.9-6.8)	0.9 (0.8-2.8)	1.19 (1.00-1.42)	0.05
Injection risk/behaviours				
Age of initial injection ≤18 years	10.8 (7.2-15.4)	1.6 (0.5-5.3)	1.26 (1.16-1.37)	＜0.001
Duration of injection drug use＞5 years	48.7 (41.8-54.4)	34.9 (33.7-48.2)	1.11 (0.99-1.25)	0.07
Had distributive needle/syringe sharing *	15.8 (10.7-20.8)	2.2 (0.6-5.8)	1.25 (1.13-1.38)	＜0.001
Injected drugs with a previously self-used needle/syringe *	69.6 (63.2-75.3)	38.3 (28.4-50.9)	1.29 (1.12-1.46)	＜0.001

	Current user (N=293) Weighted% (95%CI)	Non-current user (N=77) Weighted% (95%CI)	OR(95%CI)	P value
Sexual risk/behaviours				
Age at first sex ≤18 years	58.3 (51.5-64.2)	38.3 (25.5-48.7)	1.16 (1.03-1.31)	0.02
Number of sex partners≥2 *	20.8 (14.9-28.9)	6.8 (2.6-13.0)	1.21 (1.08-1.34)	＜0.001
Had non-regular sex partner(s) *	19.1 (13.8-25.0)	11.0 (5.4-20.1)	1.12 (0.99-1.27)	0.07
Cross-border associated activities				
Ever used drugs in Myanmar *	18.9 (13.6-23.6)	1.4 (0.6-3.6)	1.29 (1.20-1.40)	＜0.001
Ever injected drugs in Myanmar *	12.4 (8.2-16.8)	1.4 (0.6-3.5)	1.26 (1.16-1.37)	＜0.001
Ever shared injection equipment with others in Myanmar *	6.9 (3.2-10.9)	0.7 (0.6-2.3)	1.25 (1.14-1.37)	＜0.001
Reason for crossing the border *				

	Current user (N=293) Weighted% (95%CI)	Non-current user (N=77) Weighted% (95%CI)	OR(95%CI)	P value
Purchase drugs	35.0 (29.0-41.8)	6.5 (2.7-11.8)	1.31 (1.20-1.43)	＜0.001
Visit family/friends, doing business or odd jobs	13.9 (9.5-18.9)	2.1 (0.6-5.4)	1.26 (1.14-1.38)	＜0.001
Avoid capture by police	3.3 (1.4-5.5)	0.5 (0.4-1.8)	1.20 (1.03-1.40)	0.02

* Past 6 months

Table 19. Factors independently associated with current methamphetamine use (N=370)

	OR(95%CI)
Age≤25 yr (vs＞35)	1.24 (1.09-1.41)†
Syphilis positive	1.17 (1.03-1.33)
Injected drugs with a previously self-used needle/syringe *	1.20 (1.08-1.34)†
Received prevention services *	1.15 (1.04-1.28)†
Purchased drugs in Myanmar *	1.20 (1.10-1.31)‡
Visited family/friend, did business or odd jobs in Myanmar *	1.13 (1.02-1.24)

* Past 6 months † p＜0.01 ‡ p＜0.001

3. Part III: Qualitative exploration of methamphetamine use among current injection drug users in Ruili city: acceptability, availability, motivations and perceptions

A total of 10 females and 10 males aged from 24 to 62 years (mean age 36.7 years) participated in the study. Nine participants were married or were living with a partner, and 7 were from Dai and Jingpo ethnic groups. Most (16) had below senior high school education and more than half (11) were unemployed. Sixteen participants reported having a history of incarceration in their lifetime and 6 were receiving methadone maintenance treatment when this study was conducted.

All participants were primary heroin injectors and the mean number of years of drug injection was 10.6. Forty-five percent of participants reported injecting drugs daily in the past six months. Methamphetamine pill was the only used form and smoking was the only route of administration reported by all participants. Initiation of methamphetamine use occurred as recently as 6 months and as far back as 15 years prior to the interview. The frequency of use ranged from once a month to up to 5 times daily, with an average dosage ranging from 2 to 20 pills in a typical using day.

From the narratives of 20 primary heroin injectors who were also current methamphetamine users, a core theme of "why methamphetamine was widely used among this population" emerged, covering four main themes including "social accommodation of methamphetamine use", "availability and accessibility of this

drug", "motivations and context of use", and "perceived health risks associated with methamphetamine use".

3.1 It's acceptable in comparison to heroin: social attitudes towards methamphetamine use

Some interviewees described a "grade" of acceptability of substances among their local society. For example, methamphetamine was seen as "an acceptable drug", especially compared to heroin, because "the family wouldn't be ruined and people wouldn't die from using it".

"In Ruili, you can tell people you are using opium, you are using meth, but do not let them know you are using heroin. People can take opium occasionally for curing headache or slight fever, and take meth for fun, but heroin is definitely prohibited. In their opinion, taking heroin leads to death and ruins family, but they hardly hear of death caused by meth use." (Male, age 26)

"People hate heroin users. In their eyes, we are junkies, we are criminals, we ruined ourselves and our family, and we are the scum in this society. But for meth, their attitude is totally different. Most of them think meth is just like cigarettes, maybe more harmful but still acceptable." (Male, age 30)

"If the police catch you and indentify you are a heroin user, they would treat you so badly and immediately send you to the compulsory detoxification centre, and let you

stay there for two years. If you are only on meth, they just warn you or impose a fine, and then let you go." (Female, age 38)

Some participants told of their experiences of meth use in front of their parents:

"I am living with my parents and they know I am a meth user, but they do not know I am still injecting heroin. Most parents permit their kids to take meth but not heroin, so do mine. They never blamed me when I was taking it in front of them. They think I can get rid of it easily from my life…. not like heroin, that's a lifetime nightmare." (Female, age 31)

"My parents never blamed me for it; they just asked me to not take too much." (Male, age 30)

Using methamphetamine was often seen as "normal" because "so many people are on it". Meth users were described as a "motley crew" by our participants, which includes businessmen, students, workers, taxi drivers, and even government officers and policemen".

"Meth is so popular in Ruili and so many people are using or ever used it, no matter high or low, rich or poor. People think it's a sort of fashion and if you never tried, you're outdated." (Male, age 38)

"I sent polished jade to my boss and saw him using meth to treat his friends. He deemed it quite normal and never avoided others; he just put it on the table, like putting a cup of tea." (Male, age 30)

"Many junior school students take meth, which is hard to control. Teachers maybe can control it inside the campus but not outside. I live by a middle school and I often meet such kind of kids." (Male, age 36)

"More and more police take meth too. I bet if urine test can be carried out in the whole public security system, half of them will be tested as positive. I think this is related to their job because they have to work at night, just like us (laughing). Believe me, it's true. My brother is a policeman and he told me that. (Male, age 38)

Methamphetamine use was also described as a way of expressing "appreciation and welcome" at special occasions such as weddings and funeral ceremonies in some ethnic communities. A 26-year-old male participant coming from Jingpo village commented on the importance of meth for a funeral arrangement as: *"If you do not prepare it, nobody wants to give a hand."* Another 27-year-old Dai female participant said: *"Meth and alcohol have become two favourite things of people in my village. People enjoy chatting, drinking and smoking meth when they are gathering. In the earlier years, the host used to entertain their guests at home by serving a big meal, but now they treat them with meth pills."*

3.2 It's everywhere and affordable: availability and accessibility of methamphetamine in Ruili

3.2.1 Source of meth

From participants' narrative, the increase availability of methamphetamine was said to have occurred in the past several years, with most accounts suggesting "since 2006". Participants mentioned that "before there were only a few Burmese dealers", and that "now meth is sold everywhere". The rapid diffusion of methamphetamine was commented as follows:

"Not like heroin, several years ago you only could get meth in Jiegao (the earliest border trade zone between China and Myanmar) and you needed a special permit to get there. Now you can get them both from any drug dealers in downtown. The only difference is: the price of heroin keeps surging but that of methamphetamine keeps falling." (Female, age 27)

"Burmese, Xinjiang people and natives are all selling it. Different gangs have different territories. The traditional markets and old district are natives' place. Xinjiang people sell meth in some new residential quarters and Burmese occupy several main streets." (Male, age 36)

Different with the way of purchasing heroin which was usually through social networks or home delivery via telephone order, street dealing of methamphetamine

was common and all participants indicated that “anyone can get it without any difficulties”.

“I had been arrested and sent to a compulsory detoxification centre by police many times. The cops have got my name and know my face. It’s really a big risk for me to get heroin on the street. Normally I call a drug dealer I know well and let him to deliver it to me. I don’t need to call anyone for meth because I can get it easily any time near my place. It just takes me few minutes.” (Male, age 38)

“Most Burmese in the Jewellery Street (the main road for selling jewellery and jade from Myanmar) are meth dealers. All that you need to do is just ask. Sometimes if you behave like you are looking for something, they (drug dealer) also come to you and directly ask you if you want some meth for fun. Even though you get someone who really doesn’t sell it, he or she will let you know whom you can purchase it from.” (Female, age 40)

“Everyone living in Ruili knows meth and knows where to get it. Even though you are not a native, just get a cab, pay five Yuan (taxi fee), the driver can take you there.” (Male, age 24)

Most participants pointed out that the cost of meth might have an effect on their drug use behaviour such as reducing the frequency and quantity when they were short of money, but it was less likely to be the reason for them to fully stop using it.

"I inject heroin twice a day and take meth also twice, morning and night. If I don't have enough money in my pocket, I still inject heroin twice but cut down the meth to once a day." (Female, age 53)

"I haven't taken meth for couple of days because my boss deducted my money and I am hard up this month. Once I get money on next payday, I am going to do it again." (Male, age 49)

3.2.2 Price of meth

At the time of interview, the retail price of one meth pill (the cheapest type) was about 5 Yuan. This price was considered "reasonable and acceptable" by our participants even though many of them had a low economic status.

"Ruili is the heaven for drug users. You can find the cheapest drugs here. If you have 20 Yuan, you can get heroin that you need for a whole day, I mean if you are not so addicted…10 Yuan, you can get two meth pills. Tell me nowadays what kind of thing you can get with 10 Yuan? Just a pack of cigarettes. Do you know how much does one meth pill cost in Kunming (the capital city of Yunnan province)? At least 50 Yuan. Can you believe that? I really cannot imagine how people who do drugs can survive there." (Male, age 38)

Drug users can choose meth of different price levels based on their financial state, some of them also crossed the border to Myanmar to purchase methamphetamine for a lower price that only can be obtained there.

"WY Brand is the cheapest one, which has a bright red colour, and so we call it Sun Brand. It only costs 5 Yuan per pill and most heroin users choose this. Other meth pills are sold at 8 Yuan, 10 Yuan, 15 Yuan or 20 Yuan. The most expensive one is sold at 40 Yuan, which is purple and twice as thick as a normal one. Although this pill smokes so good and strong, I wouldn't like to spend my money on it." (Female, age 27)

"If you want to buy it in big quantities, like several hundreds of pills, you can get it in Myanmar because it's cheaper. The border line is very easy to cross; you know I don't mean that official crossing. If you know some wholesalers in Myanmar, you can choose to trade at the border, no need to cross it. Have you seen that open fence at the border? Normally there is no guard there, so actually there is no obstacle for passing either drugs or people there. You guys just make a call and decide where and when to meet. Then you give them money and they give you drugs. The wholesale price is only 2.5 Yuan per pill in Myanmar. Since I usually take more than 10 pills a day or even 20 to 30 pills sometimes, I go to Myanmar once a month and buy 500 pills at a time." (Male, age 29)

3.3 Motivations and context of methamphetamine use

3.3.1 It helps to enhance working energy and gain more money

Participants described using methamphetamine to serve a list of specific purposes. "Making money" was one motive since methamphetamine could help them "stay

awake" in performing their work, especially during the night time, with income generated being used to support their drug use expense (mainly referred to heroin). As one male participant said:

"My girlfriend and I live together, she is also a heroin injector. Our major income source is jade polishing. The more jades we polish, the more money we gain. Thus, most of time we do not sleep, we polish jades night after night. Only meth can give us enough energy to do such kind of things. You know now heroin is sold at a higher price than before, we two have to spend at least 100 Yuan per day for it. We really need money." (Male, age 30)

Another participant who was a garbage collector stated:

"I inject heroin in my shed and then sleep during the daytime. I go outside to work for money at night. I make money by picking through the garbage, or frankly, most of the time by stealing. I steal steel bars from construction sites or pick up something on the sly. All these things could only be possible at night. I must take two meth pills before I go, or I would be out of spirits." (Male, age 38)

One female user who was a commercial sex worker said she was introduced to methamphetamine by her co-worker (procurer). She described her initial and continued use of methamphetamine at her work place:

"I used to take heroin only and usually fell asleep after midnight, so I couldn't work well. Clients won't choose you if you are sleepy. Then my boss asked me to take some

meth. He called a dealer to send the drug. That was the first time I took it and I didn't sleep for three days. You know most clients who come to hookers after midnight are usually meth users. They prefer to pick someone who are also on meth, thus they can have sex through the whole night. If I don't use (meth), I have no patience and energy to endure the sex. I need money to buy heroin, I have no other choices but to continue using it (heroin). In this circle, using meth is really popular and normal; I bet at least half of us are on it (meth)." (Female, age 27)

3.3.2 It's helpful to enhance sexual desire and performance

"I used to be married but now I am divorced. Thus, I usually go to hookers 3 or 4 times per month. Each time I pay more than 200 Yuan for one and let her stay overnight. I am used to taking some meth pills before having sex since it makes me excited and energetic, thus I can reach an orgasm many times. I don't like wearing a condom when I have sex because it's really uncomfortable. You know what I am saying? I pay more money, I use meth, I must have a good time." (Male, age 49)

"Heroin addicts generally have sexual dysfunction. I don't know whether it (methamphetamine) works on others but it really works on me. The duration of sex may last for half an hour under the influence of meth. If I don't take it beforehand, I will ejaculate after 5 minutes or 10 minutes at most." (Male, age 29)

One male participant who was receiving methadone maintenance treatment pointed out that methamphetamine improves people's sexual function at different levels.

"It works on some guys but not all. It depends on how severe you get addicted to heroin. If you don't inject (heroin) so frequently, your sexual function will recover gradually. At this time, meth works on you. That's why some guys in MMT like using it. Now I only inject heroin 2 times a week and meth works on me." (Male, age 30)

3.3.3 It's a social and recreational activity

The majority of participants reported that they primarily used methamphetamine with others and this use was described as a "social activity" that enhanced them "being together" and "socializing with others". As one participant explained:

"We always use meth but it doesn't mean we really get addictive to it. In most cases it's just a way of socializing. We get together, we inject (heroin) together, and we smoke meth together. We rarely share heroin, but we do share meth. You have spare money, you pay this time. And next time is my turn." (Male, age 39)

Some participants said that one of the effects of methamphetamine use was an ability to enhance sociability and help them having good connection with others. It made them "more open" and less shy".

"I'm a man of few words. My friends always encourage me to take some meth pills because they say it can transform me into another person. I can become so talkative and reel off one joke after another." (Male, age 49)

"Normally I am shy and reticent. When I meet girls, I usually blush and always hesitate to talk to them. But after taking meth, things will be totally different. I feel so

good, so confident and believe I'm the best. I can chat, even flirt with girls. That feeling is so great." (Male, age 26)

A small number of participants said that their decision on methamphetamine use was mainly based on whether their peers were using it, rather than whether they felt like using it or not. They mentioned that although they did not experience any pleasure every time, they still used it when they were staying with their friends.

"Actually I don't like meth at all. It's too irritating and I usually have a sore throat and insomnia after taking it. I never buy it and only take a few pills given to me by my friends. When I stay with them, it makes me talkative and helps to pass the time, but no more than that." (Male, age 30)

"People around you always take it, and you can not just say no. Although meth is not my cup of tea and I really don't feel so high on it, I still do it with my friends, because I don't want to cast a chill over them, and I also don't want to be deemed as a boring person." (Male, age 39)

3.3.4 It helps to relieve boredom and pass the time

Because of the jobless status of some participants, their methamphetamine use was seemed to be influenced by an excess of leisure time. The drug was used to relieve boredom and pass the time. A participant who was under methadone treatment described:

"I remember one year ago when I just got released from a compulsory detoxification centre and was enrolled in methadone treatment, my parents kept a fairly close watch on me, and I had to stay at home all day. I felt so bored and started using meth since then. Now I inject heroin 2 or 3 times a month but take meth every day. Doctors in MMT clinic may do a urine test for morphine sometimes, but never for meth." (Female, age 29)

3.3.5 Concurrent use of heroin and methamphetamine

Although most participants viewed their methamphetamine use as independent from their heroin use and they purposefully sought the different effect of each drug on separate occasions, several participants still referred to injecting heroin first and following it up with taking some meth pills for achieving a synergetic effect between these two drugs, or coping with sleepiness and retardation caused by the heroin. A 39-year-old male participant described: *"The meth makes it (effects of heroin) last longer and makes me feel better. It helps not only to increase the drug effect but also to save drug consumption."* Another 26-year-old male who was a waiter in a restaurant and used methamphetamine on a daily basis explained: *"I can't let my boss and colleagues find I am a junkie. Without it (meth), I don't know how to deal with my excessive nodding and lethargy from heroin use."*

3.4 Perceived health risks associated with methamphetamine use

All participants agreed that using methamphetamine was harmful but most of them were not quite aware of the specific problems it could cause. They explained since almost all public health and media attention mainly focused on heroin use and related HIV transmission risk in the local society, there was a general lack of information on methamphetamine use for them. One 38-year-old male participant said: *"When I was in jail (compulsory detoxification centre), doctors from CDC and some NGOs often came and gave us lectures. However, all that they talked about were always heroin and HIV…. I've never seen any publicity materials aiming at methamphetamine there."*

Most participants perceived that methamphetamine wasn't an addictive drug, or "maybe it is, but at least not a very serious one", as a result of their experience of heroin use. As a 62-year-old female participant remarked: *"If you don't take heroin for one day, you may shiver, run at the nose and tear up. Methamphetamine doesn't make you feel that way, you just feel sleepy and feeble. It's not a big deal."* The potential harms from using methamphetamine were generally discounted by our participants since they haven't seen any of their friends died from using it, while they emphasised many died from a heroin overdose or from AIDS.

When asked if there was a link between methamphetamine use and the transmission of HIV, almost all of them did not think that this link existed. The main explanation given by them was *"HIV is mainly associated with injecting drugs, but we people*

never inject meth". The only one who expressed a concern about this possible link stated: *"Of course there is such a link, because meth can lead to promiscuous behaviours,* especially among young guys. I saw that happened in KTV room". However, he went on to explain that it's wouldn't be a problem for heroin injectors because *"people who are using heroin are not very interested in sex". (Male, age 37)*

CHAPTER 4

DISCUSSION

1. General discussion

This section is presented according to the study objectives. The sub-sections are 1) border region, cross-border activities and high level of methamphetamine use; 2) availability, social accommodation, motivations and perceptions of methamphetamine use; 3) risk behaviours, prevalence of HIV and HCV, utilization of harm reduction services, and population size of current injection drug users in Ruili city.

Overall, in comparison with previous studies, the lifetime and current prevalence of methamphetamine use among the IDU population in Ruili is quite high.[159, 160] IDUs living in Ruili city often cross the border into Myanmar for work, safety, visiting family and friends, or access to illicit drugs, and these cross-border activities appear to be related to the high prevalence of methamphetamine use in this population. Not only the IDUs but also the public community perceived that methamphetamine use was less harmful and more acceptable than using heroin.

Our findings also indicated the moderate levels of HIV and HCV prevalence among current IDUs compared to other studies conducted in China and other countries. [51, 145, 149, 155, 161] In addition, the growing population size of IDUs and low coverage of harm reduction services seem to have become a big concern.

1.1 Border region, cross-border activities and high level of methamphetamine use

The particularly high level of methamphetamine use observed in our study is likely to reflect the relationship between illicit drug production or trafficking, and patterns or trends of consumption in the border region. This is comparable with other regions, for example, Tijuana, a border city in Mexico situated on an international drug trafficking route from South America to the United States, has the highest prevalence of methamphetamine use in the country.[162] Likewise, being an American border county adjacent to Tijuana, San Diego has become a major distribution centre for methamphetamines entering the U.S. from Mexico and has experienced a rapid increase in methamphetamine use and abuse over the past decade.[163]

In this study, IDUs who ever purchased illicit drugs in Myanmar in the past six months were more likely to be current methamphetamine users. This association seems to be partly driven by their perceived lower price and better quality of methamphetamines that can be acquired in Myanmar, combined with the presence of a porous border between two neighbouring countries. Information collected through our informal conversations and interviews with local drug users revealed that

methamphetamines were cheaper and there were a variety of pills with different purity and tastes to choose in Myanmar. Although Ruili seems to have the lowest price of methamphetamine pill (5 Chinese Yuan (approximately USD 0.83) per pill) compared with other areas in China, such substance is cheaper in Myanmar (3 Chinese Yuan per pill) and not so difficult to obtain. Similar findings have also been shown in a study conducted in U.S.-Mexico border areas which reported that American IDUs who ever injected drugs in Mexico were price-sensitive. Drug users would cross into Mexico to purchase methamphetamines at a lower price and sell them in San Diego.[164] In the past few decades, the advantages of price and geography in this border area have made opium and heroin easily accessible in Ruili，and has led to the subsequent epidemic of drug use and HIV infection.[46] Nowadays, these factors could result in increased availability of methamphetamines and further facilitate a creation of a drug consumption market along with Myanmar's new role of being the largest producers of methamphetamines in Asia.

Furthermore, having crossed the border for visiting family, friends, or doing business or work in the past six months might have increased the current methamphetamine users' chance of drug use. This is confirmed by the fact that some participants started their methamphetamine use in Myanmar, and some had used it there in the past six months. As reported elsewhere, our participants used methamphetamines for increasing sociability, enhancing sexual performance and increasing energy in occupational settings;[165, 166] these factors could be motivations of

methamphetamine use when they met with their friends, family or business partners in Myanmar. In addition, we found that IDUs who had a larger social network size and had contact with Burmese drug users in the past 6 months were more likely to use methamphetamines, although this association did not remain statistically significant after adjusting for other factors. This supports previous findings that social networks play a key role in the initiation, maintenance and cessation of drug use and HIV-related risk behaviours.[167, 168] Communication with and exposure to members from different types of drug use networks may have caused individuals to undertake more risky behaviours.[169]

Due to the cross-sectional design of this study, we cannot determine causality of cross-border activities and the participants' drug use behaviours. However, this relationship undoubtedly affects the frequency of border crossing movements, and further increases the probability of exposure to risky behaviour and transmission of blood-borne infections. In this study, most participants (77%) were daily injection drug users and it seems unlikely that they would stop injecting drugs when they visit abroad. Injection and equipment sharing behaviour in Myanmar reported by our participants further validated this hypothesis. From previous literature,[120, 170] language barriers, lack of knowledge of local resources, economic and survival issues could become the influencing factors for engaging in high-risk behaviours in the host country, and which could further contribute to diffusion of blood-borne disease bi-nationally.[125] A recent study conducted among 298 clients enrolled in the Ruili

Methadone Maintenance Treatment Centre found that border-crossing to inject drugs was strongly associated with sharing injection equipment.[171] In the China-Vietnam border region, an association between border-crossing and being HIV sero-positive was found among Chinese IDUs.[172]

We observed that participants in the youngest age group (18–25 years) and those having received any prevention services in the past six months had a higher likelihood of using methamphetamines compared to the others. In China, at the end of 2010, among the 0.12 million people who were newly identified as synthetic drug users, most of them were younger than 25 years.[173] These findings suggest that current IDUs who also used methamphetamines might have more drug related problems and tend to access services for seeking information, treatment and interventions. However, from another perspective, there is a great concern that current intervention strategies might be inappropriate or pay less attention to the emerging epidemic of methamphetamine use. In addition, the association between using previously used syringes and current methamphetamine use status possibly indicated IDUs low perception of harms related to these behaviours, including HIV transmission.

Although we did not find significant associations between current methamphetamine use with sexual risk behaviours such as multi-sexual partners or unprotected sex and with HIV infection status, our findings, including using methamphetamines to increase libido and facilitate sexual encounters, having sexual intercourse while being high on drugs, and especially an association between the

prevalence of syphilis infection and drug use, still highlight the role of methamphetamine use in sexual contexts which increased risk of sexually transmitted diseases among this primary heroin injecting population.

1.2 Availability, social accommodation, motivations and perceptions of methamphetamine use

The findings of high availability and use of methamphetamines among the local IDU population generated from our qualitative study highlights the current emergence of methamphetamine as another predominant drug among heroin injectors in Ruili. These findings support the previous studies that revealed that the drug market is a crucial factor which can influence drug use behaviours.[174-176] Since the 1990s, the pressure from the international society and domestic eradication campaigns against opium has resulted in a decline in heroin production in the Golden Triangle. At the same time, a developed methamphetamine market in East and Southeast Asia led to the rise of methamphetamine manufacturing in this traditional heroin area.[49]

In the past several decades, Ruili had experienced great burden and negative consequences caused by heroin use and related risk behaviours.[44, 50, 51] This situation appeared to make a relative tolerance and neglect for other substances used in the local community. Compared to heroin, methamphetamine was seen as less harmful and more acceptable not only for drug users but also for their families and the whole society. Our participants also showed having little knowledge about methamphetamine from available information sources.

The shift between heroin and methamphetamine use among IDU populations has been observed in previous studies. For example, in Australia, many amphetamine injectors transited to heroin injectors during the mid 1990s when heroin was becoming cheaper and more available.[177] In Thailand, during a nationwide implementation of the "war on drugs" policy in 2003, IDUs shifted their drug consumption by injecting methamphetamine in substitution for heroin since it was almost exclusively taken off from drug market.[178] However, this is not the case here. In our study, all participants were primary heroin injectors, but most of them were smoking methamphetamine frequently as a recreational activity or serving some specific purposes. No one reported a desire to quit from heroin or reduce their frequency of drug injection because of the co-use of methamphetamine. In other words, the increase in methamphetamine smoking among this IDU population had less probability to cause a corresponding decrease in heroin injection, and hereby cannot result in a decline in HIV and other blood-borne transmissions. Instead, the sexual risk behaviours stemmed from methamphetamine use, such as facilitated casual sexual encounters while high on drugs and low levels of condom use reported by our participants increase the hazard of contracting these diseases. In addition, some participants reported they continuously used methamphetamine as a means of enhancing their working energy, thus making more money to support their cost of heroin use. This finding is worrisome because it suggests that use of methamphetamine could help maintain heroin injection among IDUs. Given these

direct and indirect impacts on risk behaviours, the extent and consequences of methamphetamine use among these primary heroin injectors should not be underestimated.

One of the most alarming issues is the perception by the IDU as well as the public that methamphetamine use is less harmful and more acceptable than heroin use. It is well-known that methamphetamine intoxication can induce euphoria, alertness, and restlessness. Upon withdrawal methamphetamine users may experience fatigue, depression, irritability, memory impairment, paranoia, psychosis, and exhibit suicidal behaviour, anger, aggression, and violence.[179] Reports from countries where methamphetamine use is highly prevalent reveal serious tragic effects of methamphetamine use permeating to all members of society, including citizens being victims of drug related property crime and motor traffic accidents, children of users suffering neglect and abuse, the criminal justice system being overwhelmed with criminal trials and incarceration, policy makers being faced with legislative decisions, and the safety of the public being compromised due to the potential irrational behaviour of methamphetamine users and environmental hazards.[180-183]

1.3 Risk behaviours, prevalence of HIV and HCV, utilization of harm reduction services, and population size of current injection drug users in Ruili city

Overall, our findings indicate a decrease in HIV prevalence (18.3%) among current IDUs, compared with a study conducted in the same area in 2005 using several data

sources, which found an estimated prevalence of HIV/AIDS among IDUs of 57.6%.[51] The decrease is also supported by an investigation about trends in the HIV epidemic in Yunnan province which reported the provincial average prevalence rate among IDUs decreased from 32.4% in 2004 to 28.4% in 2007 after a long-term increase since 1992.[184]

Similarly, the rates of lifetime (27.4%) and recent needle/syringe sharing (9.6% for receptive sharing and 12.3% for distributive sharing) among current IDUs were found to be lower than prior studies. For example, a cross-sectional survey conducted among 2080 IDUs recruited from communities, VCT clinics, NSP and MMT programmes in five different regions of Yunnan province in 2009 reported an average level of needle/syringe sharing of 33.7%.[185] Some of these differences may be attributed to different sampling techniques or data sources used. Previous studies mostly utilized convenience sampling based on venues and institutions such as clinics, detention or detoxification centres causing an oversampling of IDUs with more serious problems. Moreover, harm reduction services have started to show its positive effects on preventing HIV infection by reducing needle and syringe sharing in this group. However, it is also possible that needle/syringe sharing behaviour is under-reported because of stigmatization.[186]

Despite the above positive findings, injection risk behaviours in these IDUs remain a big concern. The identified relationship between HIV infection and duration of injecting drugs supports previous studies and suggests the importance of developing

strategies to delay the initiation of injection drug use.[187] Among our participants who were HIV sero-positive, more than two-thirds (55/70) had ever shared needles/syringes in their lifetime, and nearly one-fifth (13/70) had distributed needles/syringes to other IDUs in the past six months, posing a potential risk for HIV transmission to their syringe-sharing peers. In addition, the association between HIV and lifetime needle/syringe sharing among the current IDU population, and more than half of participants reported reusing their own syringes during the past six months, these findings reflected an inadequate access to clean needles/syringes at present and the under-coverage of NSP for the IDUs (only 32 % lifetime coverage and 28% in the past six months), compared to the expected goal of 50% in 2010 by the central government.[188] Barriers of access to NSP among IDUs could possibly be distance to the NSP site, limited operating times, strict programme regulations such as 1-for-1 exchange and fear of being arrested. All of these barriers could result in a low coverage of service and make other venues, such as pharmacies, a source of needles/syringes.[189] Like other cities in China,[190] our conversations with local IDUs in Ruili revealed that pharmacies were used as an option to get sterile injecting equipment as its sale is legal (personal communication with local injection drug users, August, 2012). However, living in mountainous areas and costs may be a barrier to this source.

Another point of concern found in this study is the low coverage of MMT among IDUs. Previous studies suggest that at least 60% coverage is required for effective

interventions to reverse or stabilize the HIV epidemic among drug users.[191] Only 11.4% of our participants had ever engaged in MMT, which seems far too low to have a sufficient impact on the HIV epidemic. Similar to the challenges faced by NSP, the geographical terrain and the cost of transportation pose difficulties for IDUs from remote areas to utilize MMT services. Approximately one fifth of our participants were non-local residents and none of them reported ever being enrolled in a local MMT clinic. Migrant status has been proven to facilitate vulnerability to drug use and transmission of infectious diseases due to the relevant economic and survival issues, social isolation, lack of knowledge or proper documentation to access local services, and fear of deportation or arrest.[120]

Apart from risky injection behaviours, sexual risk behaviours of these IDUs, including having multiple sex partners and unprotected sex, remained high and were associated with HIV infection. Among these IDUs, the prevalence of consistent condom use was very low, especially with regular sex partners, which is consistent with previous studies among drug users in China.[192]

As a major cause of chronic liver disease worldwide and a potential contributor to morbidity and mortality,[193] the HCV epidemic could not be overlooked in this study. The HCV infection rate among current IDUs in our study was moderate (41.5%), compared to other studies in South and Southeast Asia, (range 10-100%).[161] Our finding of a positive association between HIV and HCV infection is consistent with previous study among IDUs.[194] The explanation may be that the two infections have

shared routes of transmission and that HIV infection can make the host more vulnerable to HCV infection by increasing both viral infectiousness and viral susceptibility.[195] Moreover, our study supports a previous study which found an association between sharing injection paraphernalia, such as cookers and cotton filters, and HCV status.[196]

Our estimate of 2714 IDUs in Ruili is significantly higher than the 1650 IDUs (95% CI:1500~1800) estimated for the same area in 2005.[51] Comparing our estimated prevalence of IDUs (1.50%, range: 0.89-3.23%) to a population-weighted estimate of 0·36% from a systematic review (range of 0·056% in South Asia to 1·50% in Eastern Europe),[8] our figure signals a major health concern for Ruili city. According to statistics reported by law enforcement authorities in Ruili city in 2011, local police department investigated 209 drug related crime and seized 280.4 kilograms of illicit drugs. The number of registered drug users in the same year was 2051. Based on our representative sample, and an increasing population of drug addicts as well as increased proportion of IDUs at the national level,[197] our higher estimate is likely to be more convincing.

2. Strengths of this study

This is one of the few studies conducted among IDUs in China that used a representative sample and applied appropriate statistical methods to correct for differential recruitment bias; the use of mixed methods combining both quantitative and qualitative approaches, the use of validated laboratory tests for biological

specimens, and high-quality interviews without missing data also contributed substantially to the plausibility of this research. Our study on a hard-to-reach population group provides valuable insights into the current IDU population, helps to gain a better understanding of methamphetamine use patterns among a sample of primary heroin injectors, and will thus be useful for public health planning and evaluation efforts.

3. Limitations of this study

This study has several limitations. First, the cross-sectional design of the study limits the ability to make causal inferences for some variables. Second, despite the RDS method theoretically providing a representative sample of the target population once equilibrium was achieved, we did not know if there were any differences between our respondents and the possible non-respondents. Thirdly, in such a border area characterized by high population movement and mixing, we only recruited and interviewed Chinese IDUs; the characteristics of their counterparts from Myanmar, which have important implications for planning interventions tailored to the different needs, still remains unknown. Lastly, due to the non-probability sampling method used in our qualitative study, results from this part should be interpreted with caution.

4. Conclusions and recommendations

4.1 Conclusions

Methamphetamines have become another major drug of use and posed a serious cause for concern among injecting drug users living in the China/Myanmar border region. IDUs may continue to be a critical subpopulation of transmission of HIV and other infections in this region because of the increasing population and persistent high risk of injecting and sexual behaviours.

4.2 Recommendations

4.2.1 Implications for practice

Given the high prevalence of methamphetamine use, considerable cross-border activities and possible mixing among IDUs from both sides, as well as the associations we observed between them, there is an urgent need for bi-national cooperation to develop effective intervention strategies targeted to these issues. This could include network-based behavioural interventions, integration of methamphetamine related education into existing services, and increasing public awareness of the problems and harms associated with methamphetamine use. The cross-border cooperation and coordination for reducing drug supply is vital at this stage, even though this issue is quite complicated.

Our findings also underscore the need to develop innovative strategies that can improve accessibility of current harm reduction services, especially to certain

subgroups such as migrant people. Based on the local situation, for increasing the accessibility of sterile injection equipment, some strategies such as strengthening current mobile NSP services through outreach workers and piloting a pharmacy-based needle/syringe exchange programme are needed.[198] For MMT, although current established mobile services have helped with this issue to a certain extent,[199] the programme still needs to explore more flexible and effective strategies for higher coverage. Nowadays, the lack of migrant-targeted MMT policies remains a major concern in China. Greater efforts must be made to achieve the targeted outcome of effective harm reduction

In the past several decades, the prevention strategies for HIV infection among IDUs have emphasised only on reducing needle and syringe sharing. However, this appears to be inadequate and less effective against HCV; low awareness of transmission risks associated with indirect share of injection paraphernalia still remains. This calls for specific preventive education and strategies including distribution of injection preparation equipment in the NSP service and providing HCV counselling and testing services. Moreover, given a significant association between HCV and unprotected sex with regular sex partners, interventions to reduce the risk of HCV transmission from IDUs to their sexual partners are needed.[200]

Regular and specially designed preventive programs for promoting condom use among IDU are however urgently required as the prevalence of unprotected sex among this IDU population was very high. From previous studies, the reasons for

inconsistent condom use included feeling uncomfortable during sexual intercourse, believing that their partners were not infected with HIV and other STIs, or perceiving condom use as a mistrustful behaviour within an established relationship, and these reasons may also be applied to our study.[192] Accordingly, theory-based intervention programmes have proven to be effective in other countries, including psychological and behavioural counselling services, and these should be integrated within existing harm reduction programmes to promote behaviour change among IDUs in China.[201]

In our study, we considered RDS a step forward in serological and behavioural surveillance among IDUs since it was able to recruit a diverse sample of IDU who lack access to current HIV prevention and drug treatment programmes. Such surveys can be used not only to monitor the trends of drug use and related harms, but also as an entry point for prevention and care programmes if they are coupled with effective referral systems.

4.2.2 Implications for research

Given the high prevalence of methamphetamine use, persistent frequent heroin injection and risky sexual behaviours, and low utilization of harm reduction services among current IDUs in this border region, there is the need for additional research in the future. Firstly, continuous studies will be needed to explore more details about ATS use, to monitor the trends and its impact on health behaviours and outcomes, especially transmission of blood-borne diseases. Studies are also needed to continually monitor illicit drug markets for changes in the price, purity, availability,

use patterns and the associated harms of different drugs, which will add to our understanding and our ability to inform strategic policies to limit harms. Secondly, operational research is needed to identify the barriers and provide better understanding of how to increase the effectiveness of MMT and other harm reduction interventions in the local context. Finally, compared with the response to heroin use, few prevention and intervention strategies specific to ATS use are available in China. Further studies that emphasise on the effectiveness and impact of various strategies to prevent ATS use and related problems in different populations, including law enforcement approaches, community based awareness raising programmes, early intervention, and harm reduction strategies should be addressed in the future.

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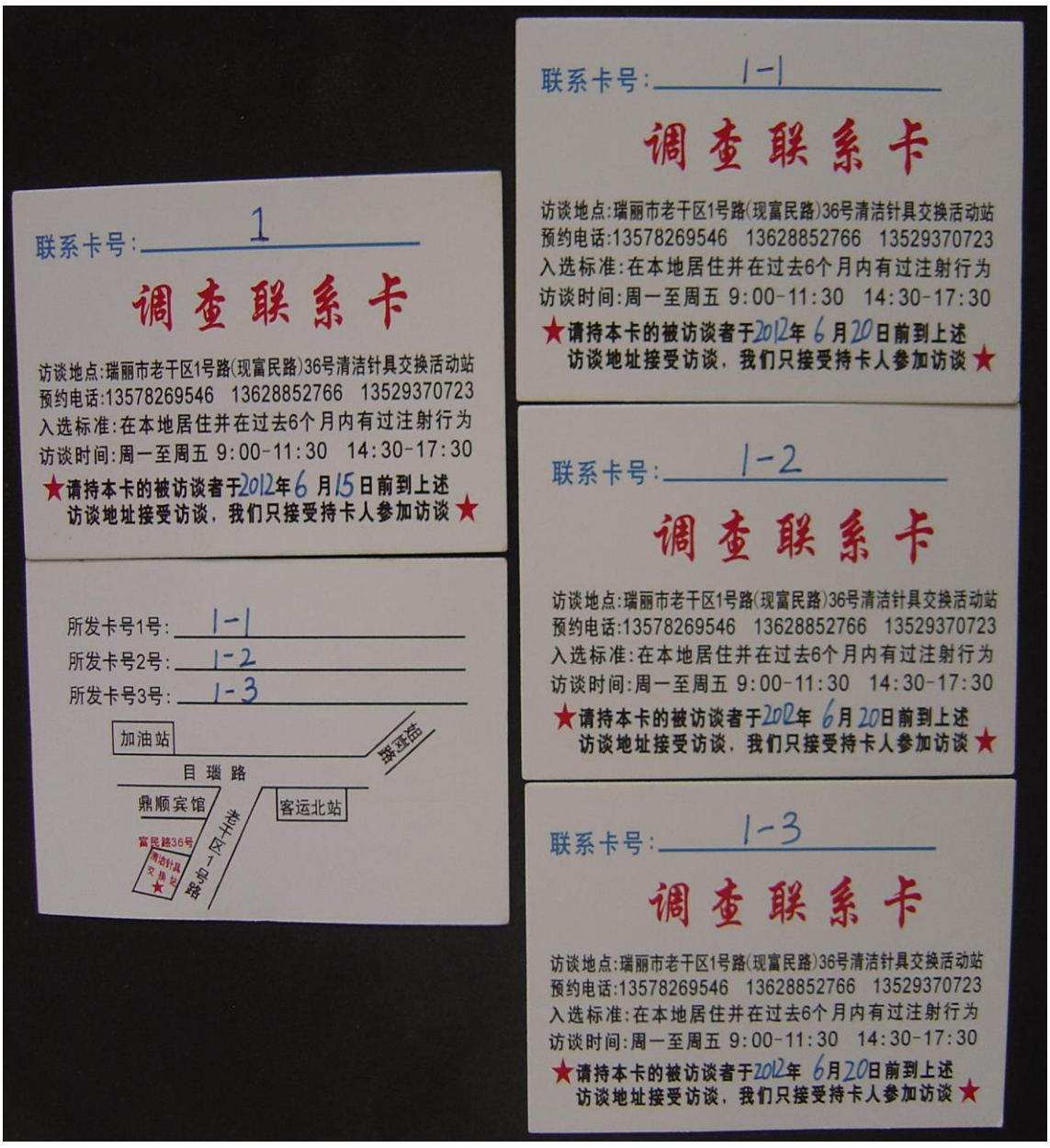
ANNEXES

Annex-1 Recruitment coupon



Annex-2 Instructions for recruitment process

Here are three coupons for you to use to recruit other IDUs. Please make sure that the persons to whom you give the coupons meet the eligibility criteria as listed below:

- Be Chinese who resides in or works in Ruili city longer than six months;
- Be 18 years of age or above;
- Injected drugs in last six months;
- Please avoid giving coupons to strangers; make sure you know them personally;
- Please make sure the person to whom you give the coupon has not received this same coupon from someone else.

Please inform those you give the coupon that:

- Information collected during the study will be kept confidential;
- They will be asked to complete a brief questionnaire and have a blood sample drawn for serologic test, including HIV, HBV, HCV and syphilis;
- The interview will take about 30 minutes;
- Once complete the interview, they will receive the primary compensation for their time (50RMB). Additionally, they will receive the secondary compensation (20RMB) for each person they recruit.

Annex-3 Screening questionnaire

Coupon number _____

Date (dd/mm/yy) ___/___/___

Questions for potential participants:

No.	Question	Eligible response	Non-eligible response
1	What's you nationality?	☐ Chinese	☐ Burmese
2	What is your current age?	☐ ≥ 18 years	☐ < 18 years
3	Have you ever injected any illegal drugs?	☐ Yes	☐ No
4	When was the last time you injected?	☐ Within 6 month	☐ > 6 months ago
5	Do you live or work in Ruili?	☐ Yes	☐ No
6	How long have you lived or worked in Ruili?	☐ ≥ 6 month	☐ < 6 months

Annex-4 Information sheet and informed consent form

Study Title:

Amphetamine-type stimulant (ATS) use and risks for HIV infection and transmission among injecting drug users in a China-Myanmar border region

Introduction

You are being invited to take part in a research. Before you decide, it is important for you to know why this research is being done and what will be done. Please take time to read the information below and discuss it with others, if you wish. Ask us if there is anything that is not clear or if you want more information. Take time to decide if you want to take part in this research.

All information you provide for this research is anonymous. No one will ask your name, and names are not recorded anywhere.

What is the purpose of the research?

We wish to find out more information about amphetamine stimulants (ATS) use and its related risks for HIV transmission among people who inject drugs, and check how many of them have HIV. This research will help us improve ways to prevent illicit drug use and HIV transmission. The HIV/AIDS Asia Regional Program (HAARP) Yunnan Office and Yunnan Institute for Drug Abuse (YIDA) are partners in this research.

Why have I been chosen?

You have been chosen because you have injected drugs in the past 6 months, or you are the key informant for this research, your experience or views are fairly valuable for us and we would like to know more and learn more from you.

Do I have to take part?

It is up to you to decide if you want to take part or not. If you decide to take part, you are still free to stop at any time and you will not have to give a reason.

What will happen to me if I take part?

(If you are invited to take part in a face-to-face interview using a questionnaire)

1. We will ask you to answer some questions, which nearly take about 45 minutes. The questions are mainly about your background, drug use, and sexual behavior. If there are questions you do not want to answer, you can skip them.
2. A staff member will talk with you about HIV testing and draw a blood specimen for serologic test of HIV, HBV, HCV and syphilis. If you wish to know the result, you can come back to find out after four weeks, but you will need to bring your coupon with you because we are not writing your name anywhere.
3. If you participate in the survey we will compensate you 60 RMB for your time and cost of travel.
4. We will also like to talk to your friends who inject drugs. We may give you coupon(s) to give them so that they can come for the interview. It is up to you to decide if you want to introduce your friends or not. If your friends complete the interview we will give you a compensation of 30 RMB for each friend who completes the interview.

(If you are invited to take part in an in-depth interview)

1. We will ask you some questions about ATS and other illicit drug use in your community, awareness, perception and attitude towards drug use and related harms, accessibility / acceptability on drug use prevention information and support services. You may also be asked some questions about drug use behaviour if you have such experiences. The entire interview will be recorded

by using a audio-recorder with your permission, and no-one will be identified because we are not writing your name anywhere. The audio-files will be kept confidential in researcher's personal computer, and no one else except the research team will have access to them. All files and information recorded will be destroyed after research finished.

2. The interview will take about 1-2 hour(s). If you participate in the interview, we will compensate you 100 RMB for your time and cost of travel.

Will my participation in this research be kept anonymous?

All questionnaires and specimens are anonymous. Names are not recorded on the questionnaires, the specimens and any other documents; only the coupon ID number (study ID number) is recorded.

What will I gain by taking part in this research?

1. If you participate in a face-to-face interview using a questionnaire, you will receive free HIV, HBV, HCV and syphilis test. If any one is positive, we will provide help to refer you for care. There is no charge to you for any of these tests. In addition, we will give you a compensation of 50 RMB for completing the interview.
2. If you participate in the in-depth interview we will give you a compensation of 100 RMB for your time and travel.
3. Also by participating in this research you are helping us know more about people who use drugs. This will help in improving drug use / HIV prevention services in China.

What is the risk of taking part in this research?

1. Some of the questions that we will ask you are very personal and you may feel embarrassed. If you do not want to answer any question, you can skip them and you will not have to give a reason.

2. For questionnaire interviewee, your blood will be tested for HIV and some other infections. This may cause anxiety. No one will know your test result because there is only a code number on the tube.

Contact for further information:

You may speak with any staff of this study. You may also contact HIV/AIDS Asia Regional Program (HAARP) Yunnan Office [Tel:0871-4626055] to speak about your rights in this study.

Your help will be of great value to us. Thank you for taking part in the research. If you want to, you can keep a copy of this sheet.

Consent Form

I, _____, confirm that I have given the information sheet to the participant with coupon number (study ID number): _____ and answered their queries.

The participant has **agreed / refused** to participate in the interview and provide a blood specimen (circle the appropriate word).

_____ _____

Signature of staff documenting consent Date

Annex-5 Research questionnaire

Study ID number: _____

Interview date: _____

Interview start time: _____ : _____ AM / PM End time: _____ : _____ AM / PM

	Signature	Date
Interviewer:	_____	_____
Questionnaire checked by:	_____	_____

Result of HIV antibody test: _____

1.Positive
2.Negative
3.Refuse drawing blood

Result of HBV antibody test: _____

1.Positive
2.Negative
3.Refuse drawing blood

Result of HCV antibody test: _____

1.Positive
2.Negative
3.Refuse drawing blood

Result of syphilis test: _____

1.Positive
2.Negative
3.Refuse drawing blood

Notes:
_____

SECTION A: BACKGROUND CHRACTERISTICS

A1.. Sex [OBSERVE]:
1 Male
2 Female

A2.. How old are you? Age in years ___ ___

A3.. What is your date of birth?
[ENTER 99 IF DON'T KNOW MONTH OR DAY, 9999 IF DON'T KNOW YEAR]

Day __ __ Month ___ ___ Year ___ ___ ___ ___

A4. What ethnic group do you belong to?
1 Dai
2 Myan
3 Jingpo
4 Han
5 Wa
6 Lahu
7 Other (specify) _____
99 Don't remember/ Don't know/Refuse

A5. In what geographic area do you live or sleep?
___ ___ ___ ___

A6. Are you the local resident (having the official local resident status)

A7. What is your current marital status?
1 Single (never married)
2 Living with a partner (not married)
3 Currently married
4 Widowed
5 Divorced
6 Separated
99 Don't remember/ Don't know/Refuse

A8. What is your highest education level that you have finished?
1 Never go to school

2 Primary school
3 Secondary school
4 High school
5 Vocational school
6 College diploma or bachelor degree
7 Other, (specify) _____
99 Don't remember/ Don't know/Refuse

A9. What is your main occupation?
[INTERVIEWR: write in space then circle appropriate code]
1 Not working/Unemployed
2 Farmer
3 Civil service in government system
4 Civil service in private sectors
5 Manual laborer for hired (for general job on daily basis)
6 Skilled worker
7 Owner of private enterprise
8 Student
9 Other, (Specify) _____
99 Don't remember/ Don't know/Refuse9

A10. During the last 6 months, did you receive any money from any of the following sources?

[INTERVIEWR: read aloud each option, circle appropriate code for each option. For those participants who answered "yes" to any of the listed items, please ask: From what source did you get most money? Circle only one code]

	Yes	No	A11. From what source did you get most money (Of the sources said YES)?
a. Working	1	2	1
b. Parent(s)	1	2	2
c. Spouse	1	2	3
d.Other relative	1	2	4
e. Girlfriend/Boyfriend	1	2	5
f. Theft, robbing, or stealing	1	2	6
g. Selling illicit drugs	1	2	7
h. Sex for money	1	2	8
i. Other (specify) _____	1		9

A12. In the last 6 months how much money a month (on average) did you get from all sources?
[ENTER 9999 IF REFUSE TO ANSWER)

___,___ ___ ___ Yuan/per month

A13. How would you describe your relationship to your recruiter (the individual who gave you the coupon)?
1 Stranger
2 Acquaintance
3 Friend
4 Lover/spouse/boy-girlfriend
5 Relative
6 Other (Specify) _____
99 Don't remember/ Don't know/Refuse

A14a.How many people who are current injection drug users (injected any drug during past six months) and they live in Ruili city longer than 6 months that you know personally by first name or nick name and they also know you personally by first name or nick name, and that you are able to contact in person?
__ ___ ___ ___ # of people [DK/RF 9999]

A14b. Of these, how many are Chinese?
___ ___ ___ ___ # of people [DK/RF 9999]

A14c. Of these, how many are at least 18 years old?
___ ___ ___ ___ # of people [DK/RF 9999]

SECTION B. ALCOHOL AND DRUG USE HISTORY

The next set of questions is about using alcohol and some drugs. Please remember that your answers are strictly confidential. Your name is not on this form. No one can trace these answers back to you. If you do not want to answer certain questions you don't have to, but please answer all the questions that you can.

Some questions might not apply to you. Please remember that we ask everyone the same set of questions, so even if a question seems not to apply to you we will ask it anyway.

ALCOHOL USE

B1. Have you ever drunk alcohol?
1 Yes
2 No→B6
99 Don't remember/ Don't know/Refuse→B6

B2. In the past 6 months (it means since ___/____/_____), how often did you drink alcohol?
1 None→B6
2 Once a month or less
3 2-3 days a month
4 About once a week
5 2-3 days a week
6 4-6 days a week
7 Everyday
99 Don't remember/ Don't know/Refuse→B6

B3. In the past 6 months (it means since ___/____/_____), what kinds of alcohol do you usually drink?

	Yes	No
a. Chinese liquor	1	2
b. Beer	1	2
c. Wine	1	2
d. Liquor/whisky	1	2
e. Other,(specify) _____	1	

B4. In the past 30 days (it means since ___/____/_____), how many days did you drink alcohol?
[ENTER 99 IF REFUSE TO ANSWER)
_____ days

B5. In the past 30 days (it means since ___/____/_____), how many days were you drunk?
[ENTER 99 IF REFUSE TO ANSWER)
_____ days

[INTERVIEWER READ:] *Now, I am going to read a list of different drugs to you. Please tell me if you have <u>ever</u> used any of these drugs.*
NR*, go to next row
DK/RF, don't know or refuse answer.

TABLE B: DRUG USE HISTORY

	A. Have you ever used these drugs? (<u>lifetime prevalence</u>)	**B. Age of initial use** [ENTER 99 IF CAN NOT ANSWER)	**C. How often did you use it in the <u>past 6 months?</u>**	**D. How did you use it in the <u>past 6 months?</u>** (Mark all apply)
B6	Heroin Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)
B7	Opium Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)
B8	Morphine Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)

	A. Have you ever used these drugs? (lifetime prevalence)	**B. Age of initial use** [ENTER 99 IF CAN NOT ANSWER)	**C. How often did you use it in the past 6 months?**	**D. How did you use it in the past 6 months?** (Mark all apply)
B9	Benzodiazepines (Diazepam/Estazolam/Triazolam/ Clonazepam) Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)
B10	Marijuana Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)
B11	Ketamine Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5 4-6 days a week 6 Everyday 7	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)
B12	Cocaine Yes 1→B No 2→NR* DK/RF* 99→NR	__ __	None use 1→NR* Once a month or less 2 2-3 days a month 3 About once a week 4 2-3 days a week 5	Inhaled/snorted/smoked 1 Ate/ ingested 2 Injected 3 Other _____ 4 (specify)

	A. Have you ever used these drugs? (lifetime prevalence)	**B. Age of initial use** [ENTER 99 IF CAN NOT ANSWER)	**C. How often did you use it in the past 6 months?**	**D. How did you use it in the past 6 months?** (Mark all apply)
			4-6 days a week 6 Everyday 7	
	Amphetamine -Type Stimulants			
B13	Methamphetamine tablets / pills Yes 1→B No 2→NR* DK/RF* 99→NR			
B14	Crystalline methamphetamine Yes 1→B No 2→NR* DK/RF* 99→NR			
B15	Ectasy type tablets / pills Yes 1→B No 2→NR* DK/RF* 99→NR			

SECTION C. DRUG INJECTION BEHAVIOURS

C1. How old were you when you injected drugs for the first time?
[ENTER 99 IF DON'T KNOW]
___ ___ Years

C2. Have you ever injected these drugs list as following in your lifetime?
1 Heroin
2 Opium
3 Morphine
4 Benzodiazepines
5 Marijuana
6 Ketamine
7 Cocaine
8 Methamphetamine pills
9 Crystalline methamphetamine
10 Ectasy
11 Others_____
99 Don't remember/ Don't know/Refuse

C3. In your lifetime, when you injected, have you ever shared any syringe and/ or needle with others?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C4. In your lifetime, when you injected, have you ever shared any other injection equipment (except syringe and needle) with others?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C5. In the last 6 months (it means since ___/____/_____), when you injected, did you ever use syringe and/ or needle that might have been used before you by someone else?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C6. In the last 6 months (it means since ___/____/_____), when you injected, did you ever lend syringe and/ or needle that have been used by you to someone else?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C7. In the last 6 months (it means since ___/____/_____), when you injected, did you ever re-use syringe and/ or needle that have been used by yourself?

1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C8. In the last 6 months (it means since ___/____/_____), when you injected, have you ever shared any other injection equipment (except syringe and needle) with others?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C9. In the last 6 months (it means since ___/____/_____), on average, how often did you inject any drug? [INTERVIEWER: READ]
1 Once a month or less
2 2 - 3 days a month
3 About once a week
4 2 - 3 days a week
5 4 - 6 days a week
6 Everyday
99 Don't remember/ Don't know/Refuse

C10. In your lifetime, have you ever injected any drug in Myanmar side?
1 Yes
2 No→D1
99 Don't remember/ Don't know/Refuse→D1

C11. In your lifetime, have you ever shared any injection equipment (including needles/syringes) with others (borrow or lend, include both) in Myanmar side?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

C12. In the last 6 months (it means since ___/____/_____), have you ever injected any drug in Myanmar side?
1 Yes
2 No→D1
99 Don't remember/ Don't know/Refuse→D1

C13. In the last 6 months (it means since ___/____/_____), have you ever shared injection equipment with others (borrow or lend, include both) in Myanmar side?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

SECTION D. SEXUAL BEHAVIOURS

[INTERVIEWER READ:]

The next set of questions is about your sexual experience. We understand that many of these questions are sensitive.

Please remember that your answers are strictly confidential. Your name is not on this form. No one can trace these answers back to you.

If you do not want to answer certain questions you don't have to, but please answer all the questions that you can. Remember it is better to skip a question than to give an answer that is not exactly true.

Some questions might not apply to you. Please remember that we ask everyone the same set of questions, so even if a question seems not to apply to you we will ask it anyway.

D1. In your lifetime, with how many different partners have you had sexual intercourse? ___ _____
Number of partners IF 0→E1

D2. How old were you when you had sexual intercourse for the first time
___ ___ Age in years
[ENTER 99 IF DON'T KNOW / DON'T REMEMBER/ REFUSE]

D3. **(For men only)** In your lifetime, with how many male partners have you had sexual intercourse?

___ ___ Number of male partners
[ENTER 99 IF DON'T KNOW OR REFUSE]

D4. In the past 6 months, with how many different partners have you had sexual intercourse? Number of partners
___ ___ IF 0→ D12
[ENTER 99 IF DON'T KNOW OR REFUSED,THEN SKIP TO D12]

TABLE D1: HETEROSEXUAL BEHAVIOUR IN THE PAST 6 MONTHS

NR* Go to next row. n/a* not applicable DK/RF* Don't know or refuse answer

	A. Partner	**B. Have you had sexual intercourse with_[A]_**	**C.NO**	**D. How often did you have sexual intercourse with _[A]_**	**E. When you had sexual intercourse with _[A]_, how often did you or your partner use a condom?**	**F. When you had sexual intercourse with _[A]_, have you ever been high on drugs?**
D5	Spouse (Wife/Husband) [CIRCLE 88, SKIP TO D7 IF RESPONDENT NEVER MARRIED]	Yes 1→C No 2→NR* n/a* 88→NR DK/RF* 99→NR	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5 Everyday 6 Refused 99	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5 Refused 99	Yes 1 No 2 DK/RF 99
D6	Girl friend /Boy friend(s)	Yes 1→C No 2→NR* DK/RF* 99→NR	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5 Everyday 6 Refused 99	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5 Refused 99	Yes 1 No 2 DK/RF 99
D7	Casual partner(s)	Yes 1→C No 2→NR* DK/RF* 99→NR	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5 Everyday 6 Refused 99	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5 Refused 99	Yes 1 No 2 DK/RF 99
D8a	Commercial sex partner(s)	Yes 1→C No 2→D10 DK/RF 99	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5	Yes 1 No 2 DK/RF 99

				Everyday 6 Refused 99	Refused 99	
D8b	Burmese commercial sex partner(s)	Yes 1→C No 2→D1 DK/RF 99	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5 Everyday 6 Refused 99	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5 Refused 99	Yes 1 No 2 DK/RF 99

TABLE D2: HOMOSEXUAL BEHAVIOUR IN THE PAST 6 MONTHS (FOR MEN ONLY)

n/a* not applicable DK/RF* Don't know or refuse answer

	A. Have you had sexual intercourse with male partner?	**B. NO**	**C. How often did you have sexual intercourse with them?**	**D. When you had sexual intercourse with them, how often did you or your partner use a condom?**	**E. When you had sexual intercourse, What of the following ways did you have most often (circle one)?**	**F. When you had sexual intercourse, have you ever been high on drugs?**
D9	Yes 1→C No 2→D11* n/a* 88→D11 DK/RF* 99→D11	— —	About once a month or less 1 2-3 times a month 2 About once a week 3 2-3 days a week 4 4-6 days a week 5 Everyday 6 Refused 99	Never use 1 Less than half the time 2 About half the time 3 More than half the time 4 Always 5 Refused 99	Receptive anal sex 1 Insertive anal sex 2 Receotuve oral sex 3 Insertive oral sex 4 DK/RF 99	Yes 1 No 2 DK/RF 99

D10. In the <u>past 30 days</u> (it means since ___/____/_____), how many times did you have sexual intercourse?

Number of times in the past 30 days ___ ___ [IF 0→D12]

D11. In the <u>past 30 days</u> (it means since ___/____/_____), how many times did you have sexual intercourse <u>without a condom</u>?

Number of times in the past 30 days without condom ___ ___

D12. The <u>most recent time</u> you had sexual intercourse, who did you have sex with, that is [READ FIRST 4 CATEGORIES]?

1 Wife/Husband
2 Girl friend/Boy friend
3 Casual partner
4 Commercial sex partner
5 Other (specify) _____
99 Don't know/ Refused

D13. The most recent time you had sexual intercourse; did you or your partner use a condom?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

D14. Have you ever exchanged drugs for sex or sex for drugs?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

SECTION E.ACCESSIBILITY AND AVAILABILITY IN HIV / DRUG USE PREVENTION INFORMATION AND RELATED SERVICES

Next I would like to ask you some questions about some information and services related to drug use and HIV/STD prevention.

TABLE F: ACCESSIBILITY OF INFORMATION AND SERVICES

	A. Have you ever received any information or services listed as following during you **lifetime**?	B. Have you ever received any information or services listed as following **in last 6 months**?
E1	VCT (voluntary counselling and testing) Yes 1→B No 2→NR DK 99→NR	VCT (voluntary counselling and testing) Yes 1 No 2→NR DK 99→NR
E2	Knowledge and prevention information related to HIV. Yes 1→B No 2→NR DK 99→N	Knowledge and prevention information related to HIV. Yes 1 No 2→NR DK 99→NR
E3	Psychological counselling and guidance Yes 1→B No 2→NR DK 99→N	Psychological counselling and guidance Yes 1 No 2→NR DK 99→NR
E4	Knowledge, prevention information and relapse coping skills related to illicit drug use. Yes 1→B No 2→NR DK 99→N	Knowledge, prevention information and relapse coping skills related to illicit drug use. Yes 1 No 2→NR DK 99→NR
E5	Knowledge about safe injection Yes 1→B No 2→NR DK 99→N	Knowledge about safe injection Yes 1 No 2→NR DK 99→NR
E6	Specific knowledge and prevention information related to ATS use. Yes 1→B No 2→NR DK 99→N	Specific knowledge and prevention information related to ATS use. Yes 1 No 2→NR DK 99→NR
E7	Knowledge and prevention information related to STI (sexual transmission infection). Yes 1→B No 2→NR DK 99→N	Knowledge and prevention information related to STI (sexual transmission infection). Yes 1 No 2→NR DK 99→NR
E8	Skill for proper condom use Yes 1→B No 2→NR DK 99→N	Skill for proper condom use Yes 1 No 2→NR DK 99→NR
E9	Free condom distribution Yes 1→B No 2→NR DK 99→N	Free condom distribution Yes 1 No 2→NR DK 99→NR

	A. Have you ever received any information or services listed as following during you **lifetime**?	B. Have you ever received any information or services listed as following **in last 6 months**?
E10	Methadone maintenance treatment (MMT) Yes 1→B No 2→NR DK 99→N	Methadone maintenance treatment (MMT) Yes 1 No 2→NR DK 99→NR
E11	Free injection equipment from NSP (needles and syringe exchange program) Yes 1→B No 2→NR DK 99→N	Free injection equipment from NSP (needles and syringe exchange program) Yes 1 No 2 DK 99

E12. From November 2011 to April 2012， during this 6-month period, have you ever got new admission or readmission at MMT clinic?

1 Yes
2 No

99 Don't remember/ Don't know/Refuse

E13. During January **2012，** have you ever got any service (received new needle/syringes) from NSP?

1 Yes
2 No

99 Don't remember/ Don't know/Refuse

E14. During April **2012，** have you ever got any service (received new needle/syringes) from NSP?

1 Yes
2 No
99 Don't remember/ Don't know/Refuse

E15. In your lifetime, how many times have you been incarcerated (in prison or jail or detention centre)?
Number of times___ ___
[ENTER 99 IF DON'T KNOW OR REFUSED.]

SECTION F. CROSS-BORDER MOBILITY AND SOCIAL NETWORK

F1. How far from your living place to border? (9999 IF DON'T KNOW)
___ ___ ___ ___km

F2. Have you ever been Myanmar during lifetime?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse→G1

F3. How often did you cross border in the last 6 months?
1 None→F8
2 Once a month or less
3 2 - 3 days a month
4 About once a week
5 2 - 3 days a week
6 4 - 6 days a week
7 Everyday
99 Don't remember/ Don't know/Refuse→F8

F4. Did you ever stay overnight in Myanmar side in the last 6 months?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

F5. On average, how long did you usually spent in Myanmar side for each time?

___ ___ ___ days
[ENTER 999 IF DON'T KNOW / DON'T REMEMBER/ REFUSE]

F6. How did you usually cross border in the last 6 months?
1 From official crossing using passport or official paper
2 From 'semi-official' crossing where one can pay a small fee to cross
3 From convenient crossing without any restriction
4 Other (specify) _____
99 Don't remember/ Don't know/Refuse

F7. What's your reason(s) for crossing border in the last 6 months?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Purchasing drugs 1 Visiting friends 6

Selling drugs	2	Visiting family	7
Avoiding police crackdown	3	Other (specify)_____	8
Migratory employment	4	Don't remember/ Don't know	99
Commerce(doing business)	5		

F8. How many 'drug partner' (friends who are also drug users) do you have currently in Myanmar side? (9999 IF DON'T KNOW)
Number of person(s) ___ ___ ___ ___

F9. How many 'drug partner' (friends who are also drug users) do you have currently in China side? (9999 IF DON'T KNOW)
Number of person(s) ___ ___ ___ ___

ATS USE QUESTIONNAIRE Ⅰ - Methamphetamine pills / tablets (MT)

This set of questions is about the ATS use. Only for those participants who answered "yes" to any of the listed ATS in Table B.. Please remember that your answer strictly confidential. Your name is not on this form. No one can trace these answers back to you. If you do not want to answer certain questions you don't have to, but please answer all the questions that you can.

MT1. How old were you when you first used it?
Age in years ___ ___

MT2. What's the main reason(s) when you used it that very first time?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

MT3. Where were you when you use it at the very first time?
1 China
2 Myanmar
99 Don't remember/ Don't know

MT4. When you used it that very first time, did you pay for it?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

MT5. When you used it that first time, were there someone else with you, or were you alone?
1 Someone else there
2 Alone→7
99 Don't remember/ Don't know→7

MT6. Would you tell me your relationship with the people who were there when you first used it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

MT7. The very first time you used it, how did you use it?

1 Inhaled, snorted, smoked
2 Ate/ orally ingested
3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

MT8. How many tablets did you use that first time?
[INTERVIEWR: Circle ONE, If the amount used is not listed from 1through 4, circle 5 and SPECIFY]

¼ tablet	1	2 tablets	4
½ tablet	2	Other,(specify)_____	5
1 tablet	3	Don't remember/ Don't know	99

MT9. After the first time you used it, how much time passed before you became a regular user?
(By regular user, I mean when did you start using this drug frequently, at least once a month on average.)
[INTERVIEWR: IF START USING YABA FREQUENTLY FROM THE NEXT DAY, RECORD 1 DAY, IF USED TO USE YABA FOR 1-2 TIMES THEN STOP OR USE YABA LESS THAN ONCE A MONTH, RECORD 99]

Circle one only
a) day(s)
__ __ b) week(s)
c)month(s)

MT10. When was the most recent time you used it?
[RECORD THE DATE THEN CIRCLE APPROPRIATE CATEGORY; ENTER 99 IF DON'T KNOW MONTH OR DAY, 9999 IF DON'T KNOW YEAR]
____/ ____/ ____ ___ ___ ___
DD MM YYYY

1 Within past 30 days
2 31-180 days
3 More than 6 months→25
4 Don't remember/ Don't know→25

MT11. In the past 6 months, (it means since ___/____/_____) on average, how often did you use this drug?
1 Once a month or less
2 2 - 3 days a month
3 About once a week
4 2 - 3 days a week
5 4 - 6 days a week
6 Everyday
99 Don't remember/ Don't know/Refuse

MT12. In the past 6 months, How did you use it normally? (Mark all apply)
1 Inhaled, snorted, smoked

2 Ate/ orally ingested
3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

MT13. On the days you used yaba in the past 6 months, on average how many methamphetamine tablets did you use per day?
[INTERVIEWR: Circle ONE, If the amount used is not listed from 1through 4, circle 5 and SPECIFY]

¼ tablet	1	2 tablets	4
½ tablet	2	Other,(specify)_____	5
1 tablet	3	Don't remember/ Don't know	99

MT14 In the past 6 months, what's the main reason(s) of using it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

MT15. In the past 6 months, where were you when you used this drug?
1 Always in China
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know

MT16. In the past 6 months, what kind of place have you been at most often when you used this drug?

_____

[INTERVIEWER: Write in response on space and then circle only one corresponding code]
1 Own home
2 Friend/partner's home
3 Dormitory
4 Bar, night club
5 Restaurant/food shop
6 Market
7 Outdoors (field)
8 Other, (Specify)_____
99 Don't remember/ Don't know

MT17. In the past 6 months, (it means since ___/____/_____) how often did you use this drug with other people who were also using it at the same time?
[READ]
1 Never use it with others→19
2 Less than half the time
3 About half the time
4 More than half the time
5 Always/almost every time
6 Don't remember/ Don't know→19

MT18. In the past 6 months, who did you use it with most often when not using by yourself?
[CIRCLE ALL THAT APPLY]

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

MT19. In the past 6 months (it means since ___/____/_____), how did you get this drug?
1 Someone else bought it for me
2 I bought it by myself
3 Someone give me for free
4 Gain from dealing drugs
5 Get drugs in exchange of se
6 Other, (Specify)_____
99 Don't remember/ Don't know

MT20. In the past 6 months, where did you get this drug?
1 Always in China→22
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know→22

MT21. In the past 6 months, why did you get this drug in Myanmar?
1 Cheaper
2 Good quality (purity is higher)
3 Easier to get
4 Safer
5 Other, (Specify)_____
99 Don't remember/ Don't know

MT22. In the past 6 months(it means since ___/____/_____), what do you usually do after taking this drug?

[INTERVIEWER: READ; CIRCLE APPROPRIATE CHOICE FOR EACH OF THE ACTIVITIES BELOW]

	Yes	No		Yes	No
a) Drinking alcohol	1	2	f) Having sex	1	2
b) Chatting	1	2	g) Doing regular house work	1	2
c) Driving/racing	1	2	h) Job-related work	1	2
d) Dancing	1	2	i) Other (specify)	1	
e) Fighting	1	2			

MT23. In the past 6 months, what do you think about the influence of this drug use on your sexual desire?
[INTERVIEWER: CHECK **QUESTION D4** TO CONFIRM IF RESPONDENT HAD SEXUAL BEHAVIOUR WITHIN PAST 6 MONTHS. IF SO, READ AND CIRCLE APPROPRIATE CHOICE]
1 Increased
2 Stayed the same/no difference
3 Decreased
4 Other (specify) _____
99 Don't remember/ Don't know
88 Not applicable

MT24. In the past 30 days, (it means since ___/____/_____), about how many days did you use it?

___ ___ Days

MT25. Have you ever used it in combination with other drugs? If so, please specify:
_____

ATS USE QUESTIONNAIRE Ⅱ- CRYSTALLINE METHAMPHETAMINE (CM)

This set of questions is about the ATS use. Only for those participants who answered "yes" to any of the listed ATS in Table B.. Please remember that your answer strictly confidential. Your name is not on this form. No one can trace these answers back to you. If you do not want to answer certain questions you don't have to, but please answer all the questions that you can.

CM1. How old were you when you first used it?
Age in years ___ ___

CM2. What's the main reason(s) when you used it that very first time?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

CM3. Where were you when you use it at the very first time?
1 China
2 Myanmar
99 Don't remember/ Don't know

CM4. When you used it that very first time, did you pay for it?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

CM5. When you used it that first time, were there someone else with you, or were you alone?
1 Someone else there
2 Alone→7
99 Don't remember/ Don't know→7

CM6. Would you tell me your relationship with the people who were there when you first used it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

CM7. The very first time you used it, how did you use it?
1 Inhaled, snorted, smoked

2 Ate/ orally ingested
3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

CM8. How many drug did you use that first time?
___ ___ gram(s)

CM9. After the first time you used it, how much time passed before you became a regular user?
(By regular user, I mean when did you start using this drug frequently, at least once a month on average.)
[INTERVIEWR: IF START USING YABA FREQUENTLY FROM THE NEXT DAY, RECORD 1 DAY, IF USED TO USE YABA FOR 1-2 TIMES THEN STOP OR USE YABA LESS THAN ONCE A MONTH, RECORD 99]

Circle one only
a) day(s)
__ __ b) week(s)
c)month(s)

CM10. When was the most recent time you used it?
[RECORD THE DATE THEN CIRCLE APPROPRIATE CATEGORY; ENTER 99 IF DON'T KNOW MONTH OR DAY, 9999 IF DON'T KNOW YEAR]
____/ ____/ ____ ___ ___ ___
DD MM YYYY

1 Within past 30 days
2 31-180 days
3 More than 6 months→25
4 Don't remember/ Don't know→25

CM11. In the past 6 months, (it means since ___/____/_____) on average, how often did you use this drug?
1 Once a month or less
2 2 - 3 days a month
3 About once a week
4 2 - 3 days a week
5 4 - 6 days a week
6 Everyday
99 Don't remember/ Don't know/Refuse

CM12. In the past 6 months, How did you use it normally? (Mark all apply)
1 Inhaled, snorted, smoked
2 Ate/ orally ingested
3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

CM13. On the days you used drug in the past 6 months, on average how many methamphetamine tablets did you use per day?
___ ___ gram(s)

CM14 In the past 6 months, what's the main reason(s) of using it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

CM15. In the past 6 months, where were you when you used this drug?
1 Always in China
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know

CM16. In the past 6 months, what kind of place have you been at most often when you used this drug?
_____
[INTERVIEWER: Write in response on space and then circle only one corresponding code]
1 Own home
2 Friend/partner's home
3 Dormitory
4 Bar, night club
5 Restaurant/food shop
6 Market
7 Outdoors (field)
8 Other, (Specify)_____
99 Don't remember/ Don't know

CM17. In the past 6 months, (it means since ___/____/_____) how often did you use this drug with other people who were also using it at the same time?
[READ]
1 Never use it with others→19
2 Less than half the time
3 About half the time
4 More than half the time

5 Always/almost every time
6 Don't remember/ Don't know→19

CM18. In the past 6 months, who did you use it with most often when not using by yourself? [CIRCLE ALL THAT APPLY]

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

CM19. In the past 6 months (it means since ___/____/_____), how did you get this drug?
1 Someone else bought it for me
2 I bought it by myself
3 Someone give me for free
4 Gain from dealing drugs
5 Get drugs in exchange of se
6 Other, (Specify)_____
99 Don't remember/ Don't know

CM20. In the past 6 months, where did you get this drug?
1 Always in China→22
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know→22

CM21. In the past 6 months, why did you get this drug in Myanmar?
1 Cheaper
2 Good quality (purity is higher)
3 Easier to get
4 Safer
5 Other, (Specify)_____
99 Don't remember/ Don't know

CM22. In the past 6 months(it means since ___/____/_____), what do you usually do after taking this drug?
[INTERVIEWER: READ; CIRCLE APPROPRIATE CHOICE FOR EACH OF THE ACTIVITIES BELOW]

	Yes	No		Yes	No
a) Drinking alcohol	1	2	f) Having sex	1	2
b) Chatting	1	2	g) Doing regular house work	1	2
c) Driving/racing	1	2	h) Job-related work	1	2
d) Dancing	1	2	i) Other (specify)	1	
e) Fighting	1	2			

CM23. In the past 6 months, what do you think about the influence of this drug use on your sexual desire?
[INTERVIEWER: CHECK **QUESTION D4** TO CONFIRM IF RESPONDENT HAD SEXUAL BEHAVIOUR WITHIN PAST 6 MONTHS. IF SO, READ AND CIRCLE APPROPRIATE CHOICE]
1 Increased
2 Stayed the same/no difference
3 Decreased
4 Other (specify) _____
99 Don't remember/ Don't know
88 Not applicable

CM24. In the past 30 days, (it means since ___/____/_____), about how many days did you use it?

___ ___ Days

CM25. Have you ever used it in combination with other drugs? If so, please specify:
_____

ATS USE QUESTIONNAIRE Ⅳ- ECSTASY TYPE TABLETS/ PILLS (ET)

This set of questions is about the ATS use. Only for those participants who answered "yes" to any of the listed ATS in Table B.. Please remember that your answer strictly confidential. Your name is not on this form. No one can trace these answers back to you. If you do not want to answer certain questions you don't have to, but please answer all the questions that you can.

ET1. How old were you when you first used it?
Age in years ___ ___

ET2. What's the main reason(s) when you used it that very first time?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

ET3. Where were you when you use it at the very first time?
1 China
2 Myanmar
99 Don't remember/ Don't know

ET4. When you used it that very first time, did you pay for it?
1 Yes
2 No
99 Don't remember/ Don't know/Refuse

ET5. When you used it that first time, were there someone else with you, or were you alone?
1 Someone else there
2 Alone→7
99 Don't remember/ Don't know→7

ET6. Would you tell me your relationship with the people who were there when you first used it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

ET7. The very first time you used it, how did you use it?
1 Inhaled, snorted, smoked

2 Ate/ orally ingested
3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

ET8. How many tablets did you use that first time?
[INTERVIEWR: Circle ONE, If the amount used is not listed from 1through 4, circle 5 and SPECIFY]

¼ tablet	1	2 tablets	4
½ tablet	2	Other,(specify)_____	5
1 tablet	3	Don't remember/ Don't know	99

ET9. After the first time you used it, how much time passed before you became a regular user?
(By regular user, I mean when did you start using this drug frequently, at least once a month on average.)
[INTERVIEWR: IF START USING YABA FREQUENTLY FROM THE NEXT DAY, RECORD 1 DAY, IF USED TO USE YABA FOR 1-2 TIMES THEN STOP OR USE YABA LESS THAN ONCE A MONTH, RECORD 99]

Circle one only
a) day(s)
__ __ b) week(s)
c)month(s)

ET10. When was the most recent time you used it?
[RECORD THE DATE THEN CIRCLE APPROPRIATE CATEGORY; ENTER 99 IF DON'T KNOW MONTH OR DAY, 9999 IF DON'T KNOW YEAR]
____/ ____/ ____ ___ ___ ___
DD MM YYYY

1 Within past 30 days
2 31-180 days
3 More than 6 months→25
4 Don't remember/ Don't know→25

ET11. In the past 6 months, (it means since ___/____/_____) on average, how often did you use this drug?
1 Once a month or less
2 2 - 3 days a month
3 About once a week
4 2 - 3 days a week
5 4 - 6 days a week
6 Everyday
99 Don't remember/ Don't know/Refuse

ET12. In the past 6 months, How did you use it normally? (Mark all apply)
1 Inhaled, snorted, smoked
2 Ate/ orally ingested

3 Injected
4 Other, (Specify)_____
99 Don't remember/ Don't know

ET13. On the days you used yaba in the past 6 months, on average how many methamphetamine tablets did you use per day?
[INTERVIEWR: Circle ONE, If the amount used is not listed from 1through 4, circle 5 and SPECIFY]

¼ tablet	1	2 tablets	4
½ tablet	2	Other,(specify)_____	5
1 tablet	3	Don't remember/ Don't know	99

ET14 In the past 6 months, what's the main reason(s) of using it?
(INTERVIEWR: READ, CIRCLE ALL THAT APPLY)

Experience/See what it is like	1	Relax	9
Fit in with a group I like (peer pressure)	2	Get away from problems	10
Feel good or get high from it	3	Relieve boredom	11
Increase energy	4	Relieve depressive thoughts	12
Increase motivation to get things done	5	Suppress appetite/diet	13
Facilitate work	6	Take it as a substitution of other drug(s)	14
Increase confidence	7	Other (specify)_____	15
Help manage effects from other drugs	8	Don't remember/ Don't know	99

ET15. In the past 6 months, where were you when you used this drug?
1 Always in China
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know

ET16. In the past 6 months, what kind of place have you been at most often when you used this drug?
_____
[INTERVIEWER: Write in response on space and then circle only one corresponding code]
1 Own home
2 Friend/partner's home
3 Dormitory
4 Bar, night club
5 Restaurant/food shop
6 Market
7 Outdoors (field)
8 Other, (Specify)_____
99 Don't remember/ Don't know

ET17. In the past 6 months, (it means since ___/____/_____) how often did you use this drug with other people who were also using it at the same time?
[READ]
1 Never use it with others→19
2 Less than half the time
3 About half the time
4 More than half the time
5 Always/almost every time
6 Don't remember/ Don't know→19

ET18. In the past 6 months, who did you use it with most often when not using by yourself?
[CIRCLE ALL THAT APPLY]

Husband/Wife	1	Neighbour	5
Boy friend/Girl friend	2	Drug Dealer	6
Sister/Brother or other relative	3	Other (specify)_____	7
Friend	4	Don't remember/ Don't know	99

ET19. In the past 6 months (it means since ___/____/_____), how did you get this drug?
1 Someone else bought it for me
2 I bought it by myself
3 Someone give me for free
4 Gain from dealing drugs
5 Get drugs in exchange of se
6 Other, (Specify)_____
99 Don't remember/ Don't know

ET20. In the past 6 months, where did you get this drug?
1 Always in China→22
2 Always in Myanmar
3 Most time in China
4 Most time in Myanmar
5 Half in China and half in Myanmar
99 Don't remember/ Don't know→22

ET21. In the past 6 months, why did you get this drug in Myanmar?
1 Cheaper
2 Good quality (purity is higher)
3 Easier to get
4 Safer
5 Other, (Specify)_____
99 Don't remember/ Don't know

ET22. In the past 6 months(it means since ___/____/_____), what do you usually do after taking this drug?

[INTERVIEWER: READ; CIRCLE APPROPRIATE CHOICE FOR EACH OF THE ACTIVITIES BELOW]

	Yes	No		Yes	No
a) Drinking alcohol	1	2	f) Having sex	1	2
b) Chatting	1	2	g) Doing regular house work	1	2
c) Driving/racing	1	2	h) Job-related work	1	2
d) Dancing	1	2	i) Other (specify)	1	
e) Fighting	1	2			

ET23. In the past 6 months, what do you think about the influence of this drug use on your sexual desire?
[INTERVIEWER: CHECK **QUESTION D4** TO CONFIRM IF RESPONDENT HAD SEXUAL BEHAVIOUR WITHIN PAST 6 MONTHS. IF SO, READ AND CIRCLE APPROPRIATE CHOICE]
1 Increased
2 Stayed the same/no difference
3 Decreased
4 Other (specify) _____
99 Don't remember/ Don't know
88 Not applicable

ET24. In the past 30 days, (it means since ___/____/_____), about how many days did you use it?

___ ___ Days

ET25. Have you ever used it in combination with other drugs? If so, please specify:
_____

Annex-6 Interview guideline

1. Knowledge and perceptions about drug use

- How do you think about these drugs ATS/heroin/other drugs)?

2. Nature and extent of drug use

- What is the extent of drug use problems in local society (ATS/heroin/other drugs)? Why people use or not use it?
- What are the change and trends in the ATS use over time? How and why?
- How about the availability of drugs? (ATS/heroin/other drugs)?

3. Social characteristics of drug users

- What are the characteristics of drug users who use/do not use ATS?
- What is the geographical location of ATS use?

4. Community norms, policy and the environment

- How do social norms influence use of different drugs (ATS/heroin/other drugs)?
- What impact do local and national policies have on different drug use (ATS/heroin/other drugs)?
- What impact do the social, economic and legal environments have on use of different drugs (ATS/heroin/other drugs)?

5. Consequences of drug use (ATS/heroin/other drugs)

6. Interventions

- What types of intervention exist for prevention, health promotion, or treatment for ATS use? To what extent are these existing interventions adequate and effective?
- What interventions aimed to ATS use are needed in future?

Annex-7 Documentary proof of ethical clearance (Yunnan Institute of Drug Abuse)

云南省药物依赖防治研究所

人类保护研究委员会

YUNNAN INSTITUTE FOR DRUG ABUSE （YIDA）

Human Studies Committee

300 Xi-hua Road, Kunming 650228, Yunnan, P.R.China

Tel:86-871-8055507 Fax:86-871-8055509

USOHRP IRB# 00002096 FWA# 00002238

Certification of IRB Approval

Project title: "Amphetamine-type stimulant (ATS) use and risks for HIV infection and transmission among injecting drug users in a China-Myanmar border region"

Principal Investigator: Dr. Li Lei, Yunnan Institute of Drug Abuse. Address: 300 Xi-hua Road, Kunming 650228, Yunnan, P.R.China. Phone: 86-871-8055505, 86-13529370723. Fax: 86-871-8055509. E-mail: lilei_8641 4@hotmail.com

Name of external sponsoring agency and contact name: The field work will be funded by HIV/AIDS Asia Regional Program (HAARP) Yunnan Office. Contact name: Dr. Duo Lin. Project Manager.

Research sites: Ruili city, Yunnan.

The progress of this project was reviewed by the IRB on May 3, 2012 and approved for a period of six months, May 1st to October 31, 2012.

Date: 03/05/2012

Dr. Jianhua Li M.D.
Chair, Institutional Review Board (IRB)
Yunnan Institute for Drug Abuse (YIDA)
300 Xi-hua Road, Kunming 60228
Yunnan, P.R.China

Annex-8 Documentary proof of ethical clearance (Prince of Songkla University)

EC: 55-205-18-5-3

คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินท
ตำบลคอหงส์ อำเภอหาดใหญ่
จังหวัดสงขลา 90110

หนังสือรับรองนี้ให้ไว้เพื่อแสดงว่า

โครงการวิจัยเรื่อง	:	Amphetamine-type stimulant (ATS) use and risks for HIV infection transmission among injecting drug users in a China-Myanmar border reg
หัวหน้าโครงการ	:	Mrs.Li Lei
ภาควิชา/คณะ	:	หน่วยระบาดวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์

ได้ผ่านการพิจารณาและได้รับความเห็นชอบจากคณะกรรมการอนุกรรมการจริยธรรมด้านวิจั
เกี่ยวกับบริบาลผู้ป่วย สิ่งส่งตรวจ และสังคมศาสตร์ ของคณะแพทยศาสตร์ มหาวิทยาลัยสงขลานครินทร์ แล้ว

ให้ไว้ ณ วันที่ 18 เมษายน 2555

.....ประธานอนุกรรมการ
(รองศาสตราจารย์นายแพทย์วีระพล จันทร์ดียิ่ง)
รองคณบดีฝ่ายวิจัย

Annex-9 Manuscripts

Manuscript 1: Cross-border activities and association with current methamphetamine use among Chinese injection drug users (IDUs) in a China-Myanmar border region

The manuscript has been published in Drug and Alcohol Dependence on 12 February, 2014

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Cross-border activities and association with current methamphetamine use among Chinese injection drug users (IDUs) in a China–Myanmar border region

Lei Li[a,b], Sawitri Assanangkornchai[b,*], Lin Duo[c], Edward McNeil[b], Jianhua Li[a]

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ABSTRACT

Background: Methamphetamine has become one of the most widely used illicit substances in the world. We measured the prevalence and identified the correlates of methamphetamine use amongst current injection drug users (IDUs) in a China–Myanmar border region.

Methods: A cross-sectional survey including interviews and serological testing was conducted in 2012. Chinese IDUs who had injected within the past six months and aged ≥18 years were recruited using respondent-driven sampling (RDS). Logistic regression indentified factors associated with current methamphetamine use.

Results: Among 370 IDUs recruited, prevalence of lifetime and current methamphetamine use was 84.2% and 75.2% respectively. Amongst 293 current users, 18.1% ever purchased methamphetamine from Myanmar while 8.9% ever used it there during the past 6 months. IDUs who had cross-border activities, including purchasing drugs (AOR: 1.20; 95% CI: 1.10, 1.31) and visiting family/friends, doing business or odd jobs in Myanmar (AOR: 1.13; 95% CI: 1.02, 1.24) were more likely to use methamphetamine in the past six months. Other factors independently associated with current methamphetamine use included being younger (aged ≤25 years, AOR: 1.24; 95% CI: 1.09, 1.41), being syphilis positive (AOR: 1.17; 95% CI: 1.03, 1.33), having used previously self-used needle/syringe (AOR: 1.20; 95% CI: 1.08, 1.34) and recently received prevention services (AOR: 1.15; 95% CI: 1.04, 1.28).

Conclusion: Methamphetamine has become another major drug of use and poses the serious concern among injecting drug users living in the China/Myanmar border region. The bi-national cooperation is urgently needed to develop targeted effective intervention strategies.

1. Introduction

As a representative of amphetamine-type stimulants (ATS), methamphetamine has become one of the most widely used illicit substances in the world. Its increasing use continues to pose significant health and social challenges (United Nations Office on Drugs and Crime (UNODC), 2009). Among the various harms attributed to methamphetamine use, the transmission of HIV has become a growing concern due to injecting drug use and especially associated high-risk sexual behaviors, including increased numbers of sexual partners, prolonged duration of sexual contact, and reduced condom use rate (Hayashi et al., 2011; Shoptaw and Reback, 2007).

In China, a long established HIV epidemic among people who inject drugs, mainly heroin, has persisted in the past two decades (State Council HIV/AIDS Working Committee Office, UN Theme Group on HIV/AIDS in China, 2007). Although heroin still remains the primary drug of choice among illicit drug users, the use of so-called 'new-type drugs,' mostly referred to as methamphetamine and other synthetic drugs such as ecstasy and ketamine, has increased significantly in recent years. At the end of 2010, 430,000 synthetic drug users who mainly used ATS were reported of the 1.5 million registered drug users in China (Global SMART Programme, 2011). However, despite its increasing use and incidence of harms, research about methamphetamine use and related risks for HIV transmission among primary heroin injecting users is still lacking

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0376-8716/

in this country. There are great concerns that methamphetamine use among these injection drug users (IDUs) would make it a group at dual risk for HIV infection due to both injection risk behaviors and risky sexual practices related to drugs.

Yunnan province is located in south-western China and borders the 'Golden Triangle,' one of the global centers of opiate-production in Southeast Asia. Drug trafficking, drug using and drug related harms such as HIV/AIDS are ongoing problems. In China, the first HIV epidemic occurred in Ruili, a city located in the border region between China and Myanmar, with the discovery of 146 HIV-infected IDUs in 1989 (Ma et al., 1990). Between 1992 and 2004, the provincial average HIV prevalence among IDUs continually increased (2.7% in 1992, 15.0% in 1995, 30.0% in 1999 and 32.4% in 2004). At the end of 2007, there were a cumulative total of 57,325 cases of HIV infections reported in the whole province (Jia et al., 2010). Nowadays, as Myanmar has become one of the world's largest producers of methamphetamine and primary source of methamphetamine pills in the Asia-Pacific region, Yunnan is also facing the critical situation since it is a major transit point for methamphetamine trafficking from Myanmar to China, then to the rest of the world (Global SMART Programme, 2012; Reid et al., 2006). In 2002, 18% of all amphetamine seizures across the whole country occurred in Yunnan province. By 2011 this figure had increased to around 50% (Global SMART Programme, 2012; United Nations Office on Drugs and Crime (UNODC), 2008).

The severity of problems associated with injection drug use and methamphetamine use makes it an important public health issue, especially in this cross-border area located in a major historical heroin trafficking route. Previous studies had indicated that individual, social and environmental factors were associated with methamphetamine use among drug users and other populations (Beyrer et al., 2004; Halkitis et al., 2003; Molitor et al., 1998; Patricia et al., 2008; Rusch et al., 2009). We undertook this exploratory study to identify the prevalence, to describe the patterns, and to examine the correlates of methamphetamine use, with regards to demographic, social and mobility-related characteristics, and risks for HIV transmission related to drug use and sexual behaviors amongst current IDUs in a China–Myanmar border region, hope to provide more evidence for health officers and policy makers to better construct target prevention and interventions.

2. Methods

2.1. Participants and recruitment

A cross-sectional survey, including interviews and serological testing was conducted between May and June, 2012. An IDU was defined as an individual who had injected any illicit drug within the last six months before the interview. Eligibility requirements included being 18 years or older, being Chinese, and having resided in or worked in Ruili for longer than six months when the study was conducted.

Respondent-driven sampling (RDS) was used to recruit participants. RDS is a chain-referral sampling method for hard-to-reach populations and theoretically can generate a sample that is much more representative than other sampling techniques (Heckathorn, 2002). In our study, a recruitment centre was set up in a drop-in centre of a needle-syringe exchange program (NSP) run by HIV/AIDS Asia Regional Program (HAARP) Yunnan Management Office and local government. One female and two male IDUs of three different age-groups (≤25, 26–35 and >35 years) and three ethnic groups (Han, Jingpo and Dai) were selected as 'seeds' of the RDS chain. Each seed was given three uniquely coded coupons, valid for 1 month to recruit his/her peers. Only eligible individuals who presented a valid coupon before expiry date were enrolled, and successively given three recruitment coupons to recruit their peers. Recruitment continued until the desired sample size and equilibrium was achieved.

The participants were initially screened by verifying track-marks. Those willing to join the study were asked to provide a blood sample. All interviews were conducted by the principle researcher of this study (LL) and two well-trained indigenous outreach workers of the NSP drop-in centre. Each participant was compensated with 50 Chinese Yuan (about 8 US dollars) for participation in the study and an additional 20 Chinese Yuan (about 3 US dollars) for successful recruitment of each eligible participant from their peer network. Written informed consent was obtained before interview. All information was kept strictly confidential and was used for research purposes only. This study was approved by the Human Studies Committee of Yunnan Institute of Drug Abuse (YIDA), China, and the Ethics Committee of the Faculty of Medicine, Prince of Songkla University, Thailand.

2.2. Measures

A structured-interview questionnaire elicited information regarding demographics, substances use history, injection and sexual risk behaviors, social network and cross-border related characteristics, lifetime history of incarceration and current utilization of prevention services. Since the outcome of interest was current methamphetamine use which was defined as having used it within the past six month prior to interview, all behavioral variables were referred to this six-month period and coded dichotomously as yes vs. no, unless otherwise stated.

Demographic variables included age (≤25 years, 26–35 years, >35 years), gender, race (other ethnic minorities vs. Han), marriage (single, living with a spouse or partner, divorced/separated/widowed), education level (primary school and below, junior high school, senior high school and above), income (>1500 Chinese Yuan vs. ≤1500), employment (unemployed vs. employed) and residential status (local resident vs. non-local). Substances use history included age at first use of any drug (≤18 years vs. >18 years) and substances used in the past 6 months for alcohol, heroin, opium, benzodiazepines and several other drugs such as marihuana, ketamine and cocaine. Additional details about methamphetamine use included motivation for initiation and continuing use, locations of use and companions, source of acquisition, frequency, whether it was used in combination with other drugs, and perceived effect on sexual performance. History of use and purchasing drugs in Myanmar was also asked.

Variables related to injection behaviors included age at initiation (≤18 years vs. >18 years), duration (>5 years vs. ≤5 years) and current frequency (daily vs. less than daily), history of sharing and reusing previously used needles and other injection equipment. Sexual behaviors investigated included age of sexual debut (≤18 years vs. >18 years), having more than one sex partner, sexual activity and condom use (consistent use vs. inconsistent use) with different type (regular or casual) of partners.

Social network related characteristics included number of known drug users (>10 vs. ≤10) and if having contact with Burmese drug users. Cross-border associated characteristics included history of travel to Myanmar in the past 6 months and reasons for crossing the border. Participants were also asked if they ever used or injected drugs in Myanmar, and if they ever shared needles and other injection equipment there.

Current utilization of prevention services was measured by 11 yes–no items including HIV counseling/testing; education services for HIV/AIDS, STI, relapse coping skills, safe injection, harm of methamphetamine and other new-type drugs, and skills of proper condom use; psychological counseling and guidance; free condom distribution; NSP and methadone maintenance treatment (MMT) program.

2.3. Laboratory testing

All blood samples were sent to the laboratory of the Centre for Disease Control and Prevention (CDC) in Ruili city for initial testing. HIV screening was conducted using two enzyme-linked immunoassays (ELISAs; Livzon Group Reagent Factory, Zhuhai, China). All reactive samples in both tests were then confirmed by a western blot test (WB test; Genelabs Diagnostics Pte Ltd., Singapore) at HIV Confirmatory Laboratory in CDC of Dehong Dai and Jingpo Autonomous Prefecture. Syphilis screening was performed by rapid plasma regain (RPR; Beijing Wantai Biologic Production Co. Ltd., Beijing, China). Specimens testing positive for syphilis antibody were confirmed by the treponema pallidum particle agglutination test (TPPA; Livzon Group Reagent Factory, Zhuhai, China), with titer ≥1:8 being considered as current infection, otherwise past infection.

Serological specimens and testing results were anonymous and were only linked to the survey data by a unique coupon number. All participants were asked to return to the NSP drop-in centre or make a phone call after three weeks to obtain their results by providing both the unique coupon number and their date of birth. Pretest counseling was provided to all participants, while posttest counseling and referrals were provided to those who were serologically positive.

2.4. Statistical analysis

For adjusting potential bias arising from RDS due to respondents' different personal social network size and homophily of recruitment, RDSAT software (Respondent-Driven Sampling Analysis Tool; version 5.6.0; www.respondentdrivensampling.org), which is specifically designed to analyze data collected through RDS, was used for descriptive analyses (giving adjusted point estimates and 95% confidence intervals) and to calculate sampling weights for all univariate and multivariate analyses.

Univariate and multivariate analyses were performed to identify factors associated with current methamphetamine use, using survey design-based methods in the R language and environment (version 2.13.0; Ihaka and Gentleman, 1996). To facilitate statistic modeling, multivariate analysis followed a conceptual framework approach (Victora et al., 1997), which had been employed in previous studies (Hawkes et al., 2009; Platt et al., 2008; Rhodes et al., 2006). All independent variables were classified into five groups. The first group was comprised of demographics and

other general information, including social network, history of incarceration, utilization of prevention and seroprevalence. Other four groups included substance use history, injection risks and behaviors, sexual risks and behaviors, and cross-border associated activities. Variables were initially examined in separate regression models for each group with current methamphetamine use as the outcome variable. Only independent variables with p-value < 0.10 in univariate analysis were considered for inclusion in these initial multivariate models. Variables that retained significance at 10% level in each model were simultaneously put in a summary regression model and further refinement was done by a backward elimination procedure. At each step, the variable with the largest p-value from the Rao–Scott likelihood ratio test was removed until all variables remaining in the final model had a p-value < 0.05.

3. Results

A total of 370 eligible participants were recruited. Almost all participants were males (92.7%) with a mean age of 36.2 years (SD = 9.4). The most common drug injected by these current IDUs was heroin (100%), and 70% of them reported a daily injection behavior in the past six months. 326 participants (84.2%) reported a lifetime history of methamphetamine use, and 293 (75.2%) reported having used it within the previous 6 months. Methamphetamine pill was the most commonly used form but 5% of them also had an experience of 'ice' (crystalline methamphetamine) use during their lifetime.

3.1. Patterns of methamphetamine use

Of 326 participants who ever used methamphetamine in their lifetime, the average age at onset was 28.6 years (SD = 9.7 years), with 8.9% having their first use in Myanmar. The majority of participants experienced their first use with their friends (82.9%) and 59.6% did not pay for it. The top five reasons for starting to use methamphetamine were: to experiment (84.6%), to get high (27.0%), to get more energy (26.5%), peer pressure (18.6%), and to relax (12.8%; Table 1).

Amongst 293 current methamphetamine users, 25.4% used methamphetamines daily, and 92.4% reported taking at least two pills in a typical using day. The main reasons for using methamphetamines changed over time, with enhancing sexual performance (31.3%) becoming a more common reason for current use, compared to initial use. Most participants used methamphetamines at their own place (57.6%) or a friend's house (52.0%), and usually used it with friends (72.4%). They usually purchased methamphetamines from drug dealers (98.2%), with one fifth reporting ever purchased methamphetamine from Myanmar for a lower price or better quality while 8.9% reported using it there during the past 6 months. Among current methamphetamine users, 34.3% reported having sexual behaviors while under the influence of the drug, and 40.2% perceived that methamphetamine use enhanced their sexual performance, although some of them did not use it purposively for sex. During the past 30 days, methamphetamines were used on average 13.7 days (SD = 11.2). Some participants reported ever using methamphetamines in combination with other drugs, including heroin (10.9%), benzodiazepines (0.7%), and a mixture of them (1.0%). In terms of route of administration, smoking and snorting were the only ways reported by all users both on initial and subsequent use.

3.2. Cross-border associated activities and social network

Most IDUs (90.7%) ever travelled to Myanmar, while 34.3%, 23.6% and 6.5% reported ever using illicit drugs, injecting drugs and sharing needles and syringes there, respectively. Within the last 6 months, 120 (32.1%) participants reported travelling to Myanmar at least once and 53 (14.2%) reported using illicit drug(s) there. Furthermore, 9.5% reported injecting drugs in Myanmar, with half of them (51.4%) sharing needles and syringes when they stayed there.

Table 1
Patterns of current methamphetamine use (N = 293).

	N	Weighted% (95%CI)	
Main reasons for use			
To get more energy	165	54.5	(48.2–60.1)
To relieve boredom	121	40.7	(33.9–47.1)
To relax	113	35.7	(30.5–41.5)
To enhance sex	86	31.3	(24.6–38.5)
Being addictive	81	26.9	(21.4–32.6)
To get high	80	24.1	(18.9–29.3)
Frequency of use			
1–3 days/month	98	36.2	(30.9–42.2)
1–6 days/week	119	38.4	(32.2–44.5)
Daily	76	25.4	(19.3–31.0)
Locations of use			
One's own home	170	57.6	(52.0–63.3)
Another's home	152	52.0	(45.7–59.4)
Outdoors	147	47.4	(40.2–54.6)
Night club or hotel	9	5.9	(2.5–9.3)
Main sources of acquisition			
From drug dealers	284	98.2	(97.0–99.3)
From friends without payment	84	25.3	(20.0–30.9)
By trading sex	1	0.3	(0.2–0.9)
Partners of use			
Alone	66	24.4	(18.3–30.6)
Friends	220	72.4	(65.6–78.7)
Spouses/girlfriends or boyfriends	22	8.9	(5.2–12.9)
Other family	9	3.1	(1.5–5.1)
Drug dealers	21	6.1	(3.8–9.0)
Location of drug purchase			
China	247	81.9	(76.8–87.2)
Myanmar	8	5.0	(1.3–9.2)
Both	38	13.1	(9.1–17.0)
Reasons for purchasing drug from Myanmar(N = 46)			
Lower price	36	83.6	(70.0–92.9)
Better quality	33	79.1	(64.5–89.9)
Easier to get	28	65.6	(46.4–79.4)
Safer	10	20.9	(7.1–36.5)

Reasons for crossing the China/Myanmar border included purchasing drugs (28.0%), visiting family/friends, doing business or odd jobs (10.8%), and avoiding capture by police (2.6%). The median number of drug users known by these participants was 8 (inter quartile range: 5, 15), and nearly one fourth (25.2%) knew more than 10 people. Of these participants, 29% reported having connections with Burmese drug users within the past 6 months.

3.3. Factors associated with current methamphetamine use

Table 2 shows variables which were associated with current methamphetamine use at $p \leq 0.10$, obtained from univariate analysis in five domains. These variables were thus entered into the initial multivariate logistic model for further analysis.

After elimination of non-significant contributors, six variables remained in the final model, namely age, syphilis status, history of using previously self-used needle/syringe, receiving prevention services, purchasing drugs in Myanmar, and crossing border to Myanmar for work or visiting family/friend. Compared to non-current methamphetamine users, the current users were more likely to be younger (aged ≤25 years; AOR = 1.24, 95%CI: 1.09–1.41), be syphilis positive (AOR = 1.17, 95%CI: 1.03–1.33), use previously self-used needle/syringe (AOR = 1.20, 95%CI: 1.08–1.34) and receive prevention services in the past six months (AOR = 1.15, 95%CI: 1.04–1.28). IDUs who had cross-border activities, including purchasing drugs in Myanmar and visiting family/friend or doing business or odd jobs in Myanmar, were 1.13–1.20 times more likely to use methamphetamines in the past six months, compared to those who did not have these activities, after controlling for other

Table 2
Factors associated with current methamphetamine use in univariate analysis ($N = 370$).

	Current user ($N = 293$)		Non-current user ($N = 77$)		OR(95%CI)	p-value	
	Weighted% (95%CI)		Weighted% (95%CI)				
Demographics and other information							
Age ≤ 25 year (vs. > 35)	16.8	(12.0–22.1)	4.3	(1.0–8.3)	1.19	(1.04–1.36)	<0.001
Other ethnic minorities (vs. Han)	57.5	(49.9–65.9)	43.5	(28.4–57.8)	1.13	(1.00–1.27)	0.05
Monthly income > 1500 (Chinese Yuan)	31.6	(26.1–37.1)	44.4	(31.5–56.3)	0.90	(0.79–1.02)	0.09
History of incarceration	82.4	(77.6–86.7)	66.6	(54.9–80.5)	1.19	(1.01–1.41)	0.04
Received prevention services[a]	59.6	(53.6–66.6)	34.9	(23.6–47.3)	1.20	(1.06–1.36)	<0.01
Social network size > 10[a]	28.1	(22.6–34.0)	16.9	(9.6–26.3)	1.12	(1.00–1.27)	0.05
Ever socialized with Burmese drug users[a]	31.6	(25.9–37.8)	20.1	(12.0–30.2)	1.11	(1.00–1.25)	0.05
HIV positive	20.4	(15.4–25.4)	12.5	(6.8–20.4)	1.11	(0.98–1.25)	0.10
Syphilis positive	8.8	(6.0–12.0)	3.4	(1.1–7.0)	1.17	(1.02–1.34)	0.03
Substance use history							
Age of initial substances use ≤ 18 years	31.1	(25.9–37.0)	13.1	(7.8–20.5)	1.19	(1.08–1.31)	<0.001
Used other drugs (marihuana, ketamine, cocaine)[a]	3.4	(0.9–6.8)	0.9	(0.8–2.8)	1.19	(1.00–1.42)	0.05
Injection risk/behaviors							
Age of initial injection ≤ 18 years	10.8	(7.2–15.4)	1.6	(0.5–5.3)	1.26	(1.16–1.37)	<0.001
Duration of injection drug use > 5 years	48.7	(41.8–54.4)	34.9	(33.7–48.2)	1.11	(0.99–1.25)	0.07
Had distributive needle/syringe sharing[a]	15.8	(10.7–20.8)	2.2	(0.6–5.8)	1.25	(1.13–1.38)	<0.001
Injected drugs with a previously self-used needle/syringe[a]	69.6	(63.2–75.3)	38.3	(28.4–50.9)	1.29	(1.12–1.46)	<0.001
Sexual risk/behaviors							
Age at first sex ≤ 18 years	58.3	(51.5–64.2)	38.3	(25.5–48.7)	1.16	(1.03–1.31)	0.02
Number of sex partners ≥ 2[a]	20.8	(14.9–28.9)	6.8	(2.6–13.0)	1.21	(1.08–1.34)	<0.001
Had non-regular sex partner(s)[a]	19.1	(13.8–25.0)	11.0	(5.4–20.1)	1.12	(0.99–1.27)	0.07
Cross-border associated activities							
Ever used drugs in Myanmar[a]	18.9	(13.6–23.6)	1.4	(0.6–3.6)	1.29	(1.20–1.40)	<0.001
Ever injected drugs in Myanmar[a]	12.4	(8.2–16.8)	1.4	(0.6–3.5)	1.26	(1.16–1.37)	<0.001
Ever shared injection equipment with others in Myanmar[a]	6.9	(3.2–10.9)	0.7	(0.6–2.3)	1.25	(1.14–1.37)	<0.001
Reason for crossing the border[a]							
Purchase drugs	35.0	(29.0–41.8)	6.5	(2.7–11.8)	1.31	(1.20–1.43)	<0.001
Visit family/friends, doing business or odd jobs	13.9	(9.5–18.9)	2.1	(0.6–5.4)	1.26	(1.14–1.38)	<0.001
Avoid capture by police	3.3	(1.4–5.5)	0.5	(0.4–1.8)	1.20	(1.03–1.40)	0.02

[a] Past 6 months.

variables in the model (AOR = 1.20, 95%CI: 1.10–1.31; AOR = 1.13, 95%CI: 1.02–1.24, respectively). There was no association between methamphetamine use and HIV sero-positivity observed among this IDU group (Table 3).

4. Discussion

Compared to other studies conducted in China and other countries, the lifetime and current prevalence of methamphetamine use among IDU population in Ruili is quite high (Li et al., 2010; Ross, 2007). The particularly high level of methamphetamine use observed in our study is likely to reflect the relationship between illicit drug production or trafficking, and patterns or trends of consumption in the border region. This is comparable with other regions, for example, Tijuana, a border city in Mexico situated on an international drug trafficking route from South America to the United States, has the highest prevalence of methamphetamine use in the country (Moreno et al., 2010). Likewise, being an American border county adjacent to Tijuana, San Diego has become a major distribution center for methamphetamines entering the U.S. from Mexico and has experienced a rapid increase in methamphetamine use and abuse over the past decade (Pollini and Strathdee, 2007).

Table 3
Factors independently associated with current methamphetamine use ($N = 370$).

	OR(95%CI)	
Age ≤ 25 year (vs. > 35)	1.24	(1.09–1.41)*
Syphilis positive	1.17	(1.03–1.33)
Injected drugs with a previously self-used needle/syringe[a]	1.20	(1.08–1.34)*
Received prevention services[a]	1.15	(1.04–1.28)*
Purchased drugs in Myanmar[a]	1.20	(1.10–1.31)**
Visited family/friend, did business or odd jobs in Myanmar[a]	1.13	(1.02–1.24)

[a] Past 6 months.
* $p < 0.01$
** $p < 0.001$

In this study, IDUs living in Ruili city often cross the border into Myanmar for work, safety, visiting family and friends, or access to illicit drugs, and these cross-border activities appear to be related to the high prevalence of methamphetamine use in this population. IDUs who ever purchased illicit drugs in Myanmar in the past six months were more likely to be current methamphetamine users. This association seems to be partly driven by their perceived lower price and better quality of methamphetamines that can be acquired in Myanmar, combined with the presence of a porous border between two neighboring countries. Information collected through our informal conversations and interviews with local drug users revealed that methamphetamine tended to be cheaper and there were a variety of pills with different purity and tastes to choose in Myanmar. Although Ruili seems to have the lowest price of methamphetamine pill (5 Chinese Yuan (approximately USD 0.83) per pill) compared with other areas in China, such substance is cheaper in Myanmar (3 Chinese Yuan per pill) and not so difficult to obtain. Similar findings have also been shown in a study conducted in U.S.–Mexico border areas, which reported that American IDUs who ever injected drugs in Mexico were price-sensitive. Drug users would cross into Mexico to purchase methamphetamines at a lower price and sell them in San Diego (Volkmann et al., 2012). In the past few decades, the advantages of price and geography in this border area have made opium and heroin easily accessible in Ruili and has led to the subsequent epidemic of drug use and HIV

infection (Xiao et al., 2007). Nowadays, these factors could result in increased availability of methamphetamines and further facilitate a creation of a drug consumption market along with Myanmar's new role of being the largest producers of methamphetamines in Asia.

Furthermore, having crossed the border for visiting family, friends, or doing business or work in the past six months might have increased the current methamphetamine users' chance of drug use. This is confirmed by the fact that some participants started their methamphetamine use in Myanmar, and some had used it there in the past six months. As reported elsewhere, our participants used methamphetamines for increasing sociability, enhancing sexual performance and increasing energy in occupational settings (Díaz et al., 2005; Halkitis et al., 2005); these factors could be motivations of methamphetamine use when they met with their friends, family or business partners in Myanmar. In addition, we found that IDUs who had a larger social network size and had contact with Burmese drug users in the past 6 months were more likely to use methamphetamines, although this association did not remain statistically significant after adjusting for other factors. This supports previous findings that social networks play a key role in the initiation, maintenance and cessation of drug use and HIV related risk behaviors (Costenbader et al., 2006; Latkin et al., 1999). Communication with and exposure to members from different types of drug use networks may have the impact on individuals to undertake more risky behaviors (Neaigus et al., 2001).

Due to the cross-sectional design of this study, we cannot determine causality of cross-border activities and the participants' drug use behaviors. However, this relationship undoubtedly affects the frequency of border crossing movement, and further increases the probability of exposure to risky behavior and transmission of blood-borne infections. In this study, most participants (77%) were daily injection drug users and it seems unlikely to stop injecting drugs when they were staying abroad. Injection and equipment sharing behavior in Myanmar reported by our participants further validated this hypothesis. From previous literature (Brouwer et al., 2009; Halkitis et al., 2003; Patricia et al., 2008; Rhodes et al., 2006; Strathdee et al., 2008), language barriers, lack of knowledge of local resources, economic and survival issues could become the influencing factors for engaging in high-risk behaviors in the host country, and which could further contribute to diffusion of blood-borne disease bi-nationally (Rachlis et al., 2007). A recent study conducted among 298 clients enrolled in the Ruili Methadone Maintenance Treatment Center found that border-crossing to inject drugs was strongly associated with sharing injection equipment (Williams et al., 2011). In the China–Vietnam border region, an association between border-crossing and being HIV sero-positive was found among Chinese IDUs (Des Jarlais et al., 2005).

We observed that participants in the youngest age group (18–25 years) and those having received any prevention services in the past six months had a higher likelihood of using methamphetamines compared to the others. In China, at the end of 2010, among the 0.12 million people who were newly identified as synthetic drug users, most of them were younger than 25 years (Global SMART Programme, 2011). These findings suggest that current IDUs who also used methamphetamine might have more drug related problems and tend to access services for seeking information, treatment and interventions. However, from another perspective, there is a great concern that current intervention strategies might be inappropriate or pay less attention to the emerging epidemic of methamphetamine use. In addition, the association between using previously used syringes and current methamphetamine use status possibly indicated their low perception of harms related to these behaviors, including HIV transmission (personal communication with local injection drug users, August, 2012).

Although we did not find significant associations between current methamphetamine use with sexual risk behaviors such as multi-sexual partners or unprotected sex and with HIV infection status, our findings, including using methamphetamines to increase libido and facilitate sexual encounters, having sexual intercourse while being high on drugs, and especially an association between the prevalence of syphilis infection and drug use, still highlight the role of methamphetamine use in sexual contexts which increased risk of sexually transmitted diseases among this primary heroin injecting population.

This study has several limitations. Firstly, the cross-sectional design of the study limits the ability to make causal inferences for some variables. Secondly, despite the RDS method theoretically providing a representative sample of the target population once equilibrium was achieved, we did not know if there were any differences between our respondents and the possible non-respondents. Thirdly, in such a border area characterized by high population movement and mixing, we only recruited and interviewed Chinese IDUs; the characteristics of their counterparts from Myanmar, which have important implications for planning interventions tailored to the different needs, still remains unknown.

Our study suggests that methamphetamines have become another major drug of use and poses a serious cause for concern among injecting drug users living in the China/Myanmar border region. Given the high prevalence of methamphetamine use, considerable cross-border activities and possible mixing among IDUs from both sides, as well as the associations we observed between them it suggests an urgent need for bi-national cooperation to develop effective intervention strategies targeted to these issues. This could include network-based behavioral interventions, integration of methamphetamine related education into existing services, and increasing accessibility of current harm reduction programs. Furthermore, future studies will be needed to explore more details about these interactions and movements that can happen both inside and outside national borders, to monitor the trends of methamphetamine use and its impact on health behaviors and outcomes, especially transmission of blood-borne diseases in this border region.

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Manuscript 2: Risk behaviours, prevalence of HIV and Hepatitis C virus infection and population size of current injection drug users in a China-Myanmar border city: results from a respondent-driven sampling survey in 2012

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- -Abstract-

Background: Injection drug use has been the major cause of HIV/AIDS in China in the past two decades. We measured HIV and hepatitis C virus (HCV) prevalence and associated risk factors among current injection drug users (IDU) in Ruili city, a border region connecting with Myanmar and has been undergoing serious drug use and HIV spread problems. An estimate of population size of current IDUs was also given.

Methods: In 2012, Chinese IDUs who had injected within the past six months and aged ≥18 years were recruited using respondent-driven sampling (RDS). Participants underwent interviews and serological testing for HIV, HBV, HCV and syphilis. Logistic regression indentified factors associated with HIV and HCV infections. Multiplier method was used to get the size of the current IDU population via combining available service data and findings from survey.

Results: Among 370 IDUs recruited, prevalence of HIV and HCV was 18.3% and 41.5% respectively. 27.1% of participants had shared needle/syringe in their lifetime. Consistent condom use rates were low with both regular partners (6.8%) and non-regular partners (30.4%). Factors independently associated with being HIV positive included HCV infection, longer history of injection drug use and experience of needle/syringe sharing. Participants with HCV infection were more likely to be HIV positive, have injected more types of drugs, have shared other injection equipments and have unprotected sex with regular sex partners. The estimated size of current IDU population in Ruili city was 2714 (95% CI: 1617-5846).

Conclusions: IDUs may continue to be a critical subpopulation of transmission of HIV and other infections in this region because of the increasing population and persistent high risk of injection and sexual behaviours. Developing innovative strategies that can improve accessibility of current harm reduction services, and can incorporate more comprehensive contents are urgently needed.

Introduction

Injection drug use, mainly heroin, has been the major cause of HIV/AIDS in China over the past two decades [1]. Although in recent years heterosexual contacts have become the dominant mode of transmission among newly diagnosed HIV cases, the majority of the cumulative HIV/AIDS infection is still attributed to epidemic of risky injection behaviours [2-4]. At the end of 2009, an estimate of 740,000 people were living with HIV/AIDS in China. Of the 48,000 new HIV infections, 24.3% were attributed to injection drug use. The reported national HIV prevalence among injection drug users (IDU) was 9.3%, with higher rates at provincial levels, including 29.0% in Xinjiang, 25.0% in Guangxi and 18.3% in Yunnan, respectively [5]

Ruili is the biggest national-level trading port with Myanmar. It is situated in Dehong prefecture in the western part of Yunnan province and connected with Myanmar on the southwest, southeast and northwest by sharing a boundary line of 169.8km. Over the past 25 years, Ruili's geographic location and expansive economic activities ranging from jade to drugs has caused severe public health problems, especially transmission of HIV/AIDS. Since the first HIV outbreak in China was identified among IDUs in Ruili in 1989, this area has become one of the most severely affected locales in the whole country [6,7] with a reported cumulative total of 4554 HIV/AIDS cases till 2009, and 41.8% transmitted by injection drug use[8].

Monitoring HIV and other blood-borne or sexually transmitted infections (STI) and related risky behaviours among IDUs is very important because they are considered as a key bridge population for the spread of these diseases from high-risk groups to the general population [9]. Although there have been previous studies about IDUs conducted in Ruili city, nearly all of them included participants recruited by convenience sampling from institutions, such as detoxification/detention centres or methadone maintenance treatment (MMT) clinics, or used secondary data from different sources such as sentinel surveillance sites [7,10], which are unlikely to

provide representative samples of targeted populations. In addition, to our knowledge, reliable population size estimation of IDUs is still lacking in this border region. To fill these gaps, we conducted a biological and behavioural survey using respondent-driven sampling (RDS), which is a chain-referral sampling method for hard-to-reach populations and theoretically can generate a sample that is much more representative than other sampling techniques [11]. The study aimed to identify the prevalence and the correlates of HIV and hepatitis C (HCV) amongst Chinese IDUs in this border city. We also used multiplier method, which is an indirect approach for estimating population size of hidden populations via combining available service data and findings from survey to get the size of the current IDU population [12]. We present our findings here, and hope to provide conclusive evidence for health officers and policy makers for planning programmatic and policy responses, guiding allocation of resources for prevention and intervention, as well as monitoring and evaluating current implementation of these strategies in a border city which has undergone an explosive HIV spread and high HIV prevalence.

Methods

Participants and recruitment

A cross-sectional survey (including interviews and serological testing) was conducted among IDUs aged 18 years or older in Ruili city, Yunnan, China between May and June 2012. An IDU was defined as an individual who had injected any illicit drug within the last six months before the interview. To obtain a representative sample of Ruili people, participants were also required to be Chinese and had resided in or worked in Ruili for longer than six months at the time the study was conducted.

Based on recommendations obtained from a prior meeting with local public health staff and outreach workers, our RDS recruitment centre was set in a drop-in centre of a needle-syringe exchange program (NSP) run by HIV/AIDS Asia Regional Program (HAARP) Yunnan Management Office and local government. The NSP staff have

good rapport with local IDUs and are well trusted by them. One female and two male IDUs of three different age-groups (≤25, 26-35 and >35 years) and three ethnic groups (Han, Jingpo and Dai) were selected as 'seeds' of the RDS chain. Each seed was given three uniquely coded coupons, which was valid for 30 days to recruit his/her peers. Individuals who could present a valid coupon before due time and who were eligible for this study were enrolled, and successively distributed, but only up to three recruitment coupons to recruit their peers. Recruitment process continued until the desired sample size (362) and equilibrium with respect to the main variables being measured was achieved. In RDS method, once reach the 'equilibrium', the sample compositions will be stable and be independent of the initial participants (seeds).

Participants were compensated with 50 Chinese Yuan (about 8 US dollars) for their participation in the study and an additional 20 Chinese Yuan (about 3 US dollars) for successful recruitment of each eligible participant from their peer network. All interviews were conducted by the principle researcher of this study (LL) and two well-trained indigenous outreach workers of the NSP drop-in centre. The participants were initially screened for their injection drug use by checking track-marks and asking some questions about drug use and then a blood sample was drawn.

Measures

Items in the questionnaire included demographic information, substance use history, injection behaviours, sexual behaviours, utilization of harm reduction services and lifetime history of incarceration. In addition, the information about social network size that was required for RDS purpose to reduce bias that may occur through oversampling of homogenous networks was also collected [13].

Participants were asked about their lifetime and current (in the past 6 months) history of drug use and injection behaviours. Drug use history included the types of substances used (including alcohol and prescription drugs used illegally) and initial age of use. Injection behaviours investigated in this study mainly included age at

initiation, types of substances injected, frequency of injection, history of sharing and using used needles/syringes and other injection equipment.

For sexual behaviour, participants were asked how many sex partners they ever had both in lifetime and the past 6 months. They were also asked if they had regular (spouses, boy/girl friends) or non-regular partners (casual sex partners, sex workers/ sex clients) in the past 6 months, and the frequency of condom use with different types of partners. Other measures included age of sexual debut, engaging in sex under the influence of any drugs (past 6 months), and history of having drug-sex exchange trade.

Lifetime and current utilization of harm reduction services were measured by 11 yes-no items regarding education and counselling/testing about HIV/AIDS and drug use, safe injection and proper condom use skills, and access to free condom distribution, MMT and needle-syringe exchange program.

Laboratory Testing

Each participant provided 7 ml intravenous blood for serological testing of HIV, hepatitis C virus (HCV), syphilis antibody and hepatitis B virus (HBV) surface antigen (HBsAg). All samples were sent to a laboratory of the Centre for Disease Control and Prevention (CDC) in Ruili city for initial testing.

HIV screening was conducted using two enzyme-linked immunoassays (ELISAs; Livzon Group Reagent Factory, Zhuhai, China). If both tests were reactive, a western blot test (WB test; Genelabs Diagnostics Pte Ltd., Singapore) was conducted for confirmation at HIV Confirmatory Laboratory in CDC of Dehong Dai and Jingpo Autonomous Prefecture. The sample was considered HIV positive when both the ELISA and WB tests were positive. The presence of HBsAg and anti-HCV antibody was detected by ELISA (ELISA; Beijing Wantai Biologic Production Co. Ltd, Beijing, China). Syphilis screening was performed by rapid plasma regain (RPR; Beijing Wantai Biologic Production Co. Ltd, Beijing, China). Specimens testing positive for syphilis antibody were confirmed by the treponema pallidum particle

agglutination test (TPPA; Livzon Group Reagent Factory, Zhuhai, China), with titer ≥1:8 being considered as current infection and otherwise past infection.

Serological specimens and testing results were anonymous and were only linked to the survey data by a unique coupon number. All participants were asked to return or make a phone call after three weeks to obtain their results by providing both the unique coupon number and their date of birth. Pretest counselling was provided to all participants, while posttest counselling and referrals were provided to those who were serologically positive.

Multiplier method for population size estimation

As one of the indirect approaches for estimating size of hidden populations, the multiplier method has been increasingly used in different settings in recent years because of its simplicity in implementation [14, 15]. Use of the multiplier method depends on the availability and quality of data collected from two sources. The first source, known as "benchmark data", is usually obtained from institutions or intervention programs and the second, namely "multiplier data", is usually obtained from a behavioural survey of a target population based on a probability sampling technique [12]. These two data sources are also required to be independent of each other, and somewhat overlap in a known way, that is, the population being counted has probability to be included in either or both sources [16]. Once meeting these assumptions, the population size can be calculated from the formula:

$$N = M / P$$

where N is the size of population being estimated, M is the benchmark data which can be the number of subjects in a target population who have accessed services in selected institutions or the intervention programs over a specified time frame, and P is the proportion of the target population who report a utilization of corresponding services during the same period.

To fulfill the major assumptions mentioned above, we obtained our benchmark data from a local MMT clinic. In China, the eligibility criteria of MMT include age at least 20 years, being a permanent local resident or having resided in this place more than six months, having had a history of multiple unsuccessful treatment, having received compulsory detoxification treatment at least twice or rehabilitation through labor treatment at least once [17]. To avoid duplication of data, only the newly admitted IDUs (including new admissions and readmissions) in the past six months prior to the RDS survey (before May 2012) in the MMT clinic in Ruili city were counted. To get the proportion of IDUs who reported an admission of MMT during the same period, the respondents in our RDS survey were asked if they were enrolled in the local MMT clinic during November 2011 to April 2012.

Statistical analysis

For adjusting potential bias arising from RDS due to respondents' different personal social network size and homophily of recruitment, RDSAT software (Respondent-Driven Sampling Analysis Tool; version 5.6.0; www.respondentdrivensampling.org), which is specifically designed to analyze data collected through RDS, was used for descriptive analyses and to calculate sampling weights for all univariate and multivariate analyses. The weighted prevalence of HIV, HBV, HCV and syphilis, drug use and injection behaviours, sexual behaviours, and coverage of harm reduction services in the different time periods were described. Adjusted point estimates and 95% confidence intervals (CI) were given for all variables.

Univariate and multivariate logistic regression were performed to identify factors associated with HIV and HCV infections, using survey design-based methods in the R language and environment (version 2.13.0) [18]. Independent variables associated with the outcome at p-value<0.10 in univariate analysis were considered for inclusion in initial multivariable model and further refinement of the model was done by a backward elimination procedure. At each step, the variable with the largest p-value

from the Rao-Scott likelihood ratio test was removed until all variables remaining in the final model had p-value< 0.05.

Ethics statement

Written informed consent was obtained before interview. All information was kept strictly confidential and was used for research purposes only. All data were recorded and analyzed anonymously. This study was approved by the Human Studies Committee of Yunnan Institute of Drug Abuse (YIDA), China, and the Ethics Committee of the Faculty of Medicine, Prince of Songkla University, Thailand.

Results

A total of 370 eligible participants were recruited after 11 waves. Equilibrium was achieved by wave 7 with regard to some key variables such as gender, age, ethnicity, marital status, education level, occupation, residential status, and infection rates of HIV, HBV, HCV and syphilis.

Social-demographics, utilization of services and prevalence of HIV / HBV / HCV /syphilis

Almost all participants were males with a mean age of 36.2 years (SD=9.4). Most were local residents of Ruili with more than half being from an ethnic minority such as Jingpo and Dai. Over one-thirds were single and most had below junior high school education. Most participants were holding a job with one-third each working as a farmer or casual laborer. Almost 80% reported having a history of incarceration in their lifetime. (Table 1)

Half (49.3%) of the participants reported having received more than six types of prevention services during their lifetime with 53.4% reporting using any of these services in the past 6 months. Lifetime utilization of NSP and MMT was reported by 32.0% and 11.4% of participants, respectively while 28% and 3.5% reported having used NSP and MMT services in the past six months. The estimated prevalence of

HIV, HBV, HCV, and current syphilis-infection was 18.3%, 9.8%, 41.5 %, and 7.5% respectively.

Drug use and injection behaviours

The mean age at first use of any substances (excluding alcohol) was 23.3 (SD=3.7) years, with up to 26.4% starting before the age of 18 years. Heroin, alcohol and ATS were the three most prevalent substances used by participants in their lifetime. Use of other substances included opium, benzodiazepines, marijuana, ketamine, Demerol® and cocaine. About 70% of the respondents had used at least three kinds of substances in their lifetime with a range of 2-8 kinds (median = 4, inter-quartile range (IQR) = 3, 5). In the past 6 months, besides heroin, the most frequently used drug was ATS, followed by alcohol, benzodiazepines and opium. (Table 2)

The mean age at first drug injection was 28.9 years (SD=8.8) with 8.4% starting before the age of 18 years. Almost half (45.8%) had injected drugs for more than five years (mean 7.2 years, SD 6.4). Heroin, diazepam and Demerol® were the most common drugs injected by IDUs in their lifetime (100%, 34.2% and 3.9%, respectively). Of all, 36.1% had injected more than one type of drugs and 27.1% and 62.3% had shared needle/syringe and other injection equipment such as bottles, spoons, cotton, filters, solution or rinsing water from a shared container with others in their lifetime.

In the past six months, 77% of participants reported injecting drugs daily while the rest did so monthly or weekly. The most common drugs of use for current IDUs were heroin (100%), diazepam (21.8%) and Demerol® (2.1%). Receptive needle/syringe sharing accounted for 9.6%, distributive sharing 12.3% and other equipment sharing 34.1% of all IDUs. Sixty-two percentage reported ever injecting with a previously self-used needle or syringe.

Sexual risk behaviours

Nearly all participants (367) reported having a sexual encounter in their lifetime. Amongst them, the mean age at sexual debut was 18.9 years (SD=3.2), and 53.1% were sexually active before 18 years of age. The majority (83.5 %) reported having two or more sex partners in their lifetime.

In the previous six months, 51.7% of the participants reported having sexual intercourse, including 17.6% had more than one partner. Of these, 82% had a regular partner in the past six months and 93.2% of them reported having unprotected sex with this type of partner. Having sex with non-regular partners was reported by 33.6% of respondents and among these 69.6% reported inconsistent condom use with these partners. Twenty-eight percentage of those who ever had sex used a condom during their last sexual episode.

Having sexual behaviours when high on drugs was reported by 57.0% of participants who had sex in the past six months. Experience of drug–for-sex exchange was reported by 2.4% of participants.

Factors associated with HIV status

In the adjusted univariate analysis, variables marginally associated with the outcome variable of HIV sero-status ($p<0.10$) included age-group, HCV and syphilis infection, history of incarceration, duration of drug injection, number of drugs injected, needle/syringe sharing and reusing in lifetime and past six months, frequency of injection and condom use with non-regular partners. In the multivariate analysis, HCV infection, having a history of injection drug use more than five years and having experience of sharing needles and syringes with others during their lifetime were independently and significantly associated with being HIV positive. (Table 3a, Table 3b)

Factors associated with HCV infection

Variables associated with HCV infection in the univariate analysis included HIV status, history of incarceration, duration of injection drug use, numbers of drugs used,

needle/syringe and other equipment sharing in lifetime and past six months, reusing needle/syringe, frequency of injection and condom use with regular partner. Four variables were found to be independently associated with HCV infection in the final model, namely HIV infection, having injected more than one type of drug during lifetime, having shared other injection equipments in the past and having unprotected sex with regular sex partner within the past six months. (Table 3a, Table 3b)

Estimated IDU population size

Our RDS survey revealed that the proportion of those who reported having an admission in the MMT clinic between November 2011 and April 2012 was 2.8% (95%CI: 1.3-4.7%).The number of IDUs who were newly admitted or re-admitted in the MMT clinic during the same time period was 76, thus the total number of IDUs based on this data source was estimated to be 2714 (95%CI: 1617-5846). Based on the census data in 2011, the total population of Ruili City was 181,239 (including unregistered citizens), the prevalence of IDUs was thus estimated to be 2714/181,239 = 1.50% (range 0.89%-3.23%).

Discussion

Overall, our findings indicate a decrease in HIV prevalence (18.3%) among current IDUs, compared with a study conducted in the same area in 2005 using several data sources, which found an estimated prevalence of HIV/AIDS among IDUs of 57.6% [7]. The decrease is also supported by an investigation about trends in the HIV epidemic in Yunnan province which reported the provincial average prevalence rate among IDUs decreased from 32.4% in 2004 to 28.4% in 2007 after a long-term increase since 1992 [4].

Similarly, the rates of lifetime (27.4%) and recent needle/syringe sharing (9.6% for receptive sharing and 12.3% for distributive sharing) among current IDUs were found to be lower than prior studies. For example, a cross-sectional survey conducted among

2080 IDUs recruited from communities, VCT clinics, NSP and MMT programs in five different regions of Yunnan province in 2009 reported an average level of needle/syringe sharing of 33.7% [19]. Some of these differences may be attributed to different sampling techniques or data sources used. Previous studies mostly utilized convenience sampling based on venues and institutions such as clinics, detention place or detoxification centre causing an oversampling of IDUs with more serious problems. Moreover, harm reduction services have started to show its positive effects on preventing HIV infection by reducing needle and syringe sharing in this group. However, it is also possible that needle/syringe sharing behaviour is under-reported because of stigmatization [20].

Despite the above positive findings, injection risk behaviours in these IDUs remain a big concern. The identified relationship between HIV infection and duration of injecting drugs supported previous studies and suggests the importance of developing strategies to delay the initiation of injection drug use [21]. Among our participants who were HIV sero-positive, more than two-thirds (55/70) had ever shared needles/syringes in their lifetime, and nearly one-fifth (13/70) had distributed needles/syringes to other IDUs in the past six months, posing a potential risk for HIV transmission to their syringe-sharing peers. In addition, the association between HIV and lifetime needle/syringe sharing among the current IDU population, and more than half of participants reported reusing their own syringes during the past six months, these findings reflected an inadequate access to clean needles/syringes at present and the under-coverage of NSP for the IDUs (only 32 % lifetime coverage and 28% in the past six months), compared to the expected goal of 50% in 2010 by the central government [22].Barriers of access to NSP among IDUs could possibly be distance to the NSP site, limited operating times, strict program regulations such as 1-for-1 exchange and fear of being arrested. All of these barriers could result in a low coverage of service and make other venues, such as pharmacies, a source of needles/syringes [23]. Like other cities in China [24], our conversations with local IDUs in Ruili revealed that pharmacies were used as an option to get sterile injecting

equipment as its sale is legal (personal communication with local injection drug users, August, 2012). However, living in mountainous areas and costs may restrict this source. Based on this local situation, we emphasise the need for increasing the accessibility of sterile injection equipment, such as strengthening current mobile NSP services through outreach workers and trialing a pharmacy-based needle/syringe exchange program [25].

Another point of concern found in this study is the low coverage of MMT among IDUs. Previous studies suggest that at least 60% coverage is required for effective interventions to reverse or stabilize the HIV epidemic among drug users [26]. Only 11.4% of our participants had ever engaged in MMT, which seems far too low to have a sufficient impact on HIV epidemic. Similar to the challenges faced by NSP, the geographical terrain and the cost of transportation pose difficulties to IDUs from remote areas to utilize MMT services. Although current established mobile services have helped with this issue to a certain extent [27], for higher coverage, the program might need to explore more flexible and effective strategies. Besides, eligibility criteria required by Chinese MMT undoubtedly may deter IDUs who actually could have benefited from it, including unexposed or migrant people. Approximately one fifth of our participants were non-local residents and none of them reported ever being enrolled in a local MMT clinic. Migrant status has been proven to facilitate vulnerability to drug use and transmission of infectious diseases due to the relevant economic and survival issues, social isolation, lack of knowledge or proper documentation to access local services, and fear of deportation or arrest [28]. Nowadays, the lack of migrant-targeted MMT policies remains a major concern in China. Greater efforts must be made to achieve the targeted outcome of harm reduction.

Apart from risky injection behaviours, sexual risk behaviours of these IDUs, including having multiple sex partners and unprotected sex, remained high and were associated with HIV infection. Among these IDUs, the prevalence of consistent condom use was very low, especially with regular sex partners, which is consistent

with previous studies among drug users in China [29]. The reasons for inconsistent condom use reported in previous studies included feeling uncomfortable during sexual intercourse, believing that their partners were not infected with HIV and other STIs, or perceiving condom use as a mistrustful behaviour within an established relationship [29]**.** These reasons may also be applied to our study and may be due to a lack of effective behavioural intervention, especially designed for changes of sexual risk behaviours related to HIV infection in the current policies [30]. Accordingly, theory-based intervention programs have proven to be effective in other countries, including psychological and behavioural counselling services, and these should be integrated within existing harm reduction programs to promote behaviour change among IDUs in China [30].

As a major cause of chronic liver disease worldwide and a potential contributor to morbidity and mortality [31], the HCV epidemic could not be overlooked in this study. The HCV infection rate among current IDUs in our study was moderate (41.5%), compared to other studies in South and Southeast Asia, (range 10-100%) [32]. Our finding of a positive association between HIV and HCV infection is consistent with previous study among IDUs [33]. The explanation may be that the two infections have shared routes of transmission and that HIV infection can make the host more vulnerable to HCV infection by increasing both viral infectiousness and viral susceptibility [34]. Moreover, our study supports a previous study which found the association between sharing injection paraphernalia such as cookers and filtration cotton and HCV sero-positive [35]. In the past several decades, the prevention strategies for HIV infection among IDUs emphasised only on reducing needles and syringes sharing. However, this appears to be inadequate and less effective against HCV [36]; low awareness of transmission risks associated with indirect share of injection paraphernalia still remains. This calls for specific preventive education and strategies including distribution of injection preparation equipment in the NSP service and providing HCV counselling and testing services. Moreover, given a significant association between HCV and unprotected sex with regular sex partners, interventions

to reduce the risk of HCV transmission from IDUs to their sexual partners are needed [37].

Another interesting finding in this study was a particularly high level of ATS use (85% lifetime use) among IDUs compared to other studies [38]. This may be attributed to the special geographic location of this border region, which is an important transit point for major methamphetamine trafficking from Myanmar to China and abroad. As reported in other studies [39], ATS use by IDUs poses more harm, especially from high-risk sexual behaviours. This is a serious concern and needs further research to describe the contexts, associated behaviours, and health outcomes of ATS use among these primary heroin IDUs.

Our estimate of 2714 IDUs in Ruili is significantly higher than the 1650 IDUs (95% CI:1500~1800) estimated for the same area in 2005 [7]. Based on our representative sample, and an increasing population of drug addicts as well as increased proportion of IDUs at the national level [5]**,** our higher estimate is likely to be more convincing. Comparing our estimated prevalence of IDUs (1.50%, range: 0.89-3.23%) to a population-weighted estimate of 0·36% from a systematic review (range of 0·056% in South Asia to 1·50% in Eastern Europe) [40], our figure signals a major health concern for Ruili city.

Our study has several limitations. First, self-reported data, especially on sensitive questions such as drug use and sexual behaviours, may have resulted in an under-reporting of the real situation. Second, the lifetime and six-month recall period might have caused recall problems for some participants. Third, we could not get any information from the IDUs (if any) who refused to join this study. Although the RDS method could theoretically provide a representative sample of target population once the equilibrium was achieved, we did not know if there were any differences between our respondents and the possible non-respondents.

Despite these limitations, this is one of the few studies conducted among IDUs in China that used a representative sample and applied appropriate statistical methods to

correct for differential recruitment bias. It provides valuable insights into the current IDU population and will be useful for public health planning and evaluation efforts. Our findings suggest that IDUs may continue to be a critical subpopulation of transmission of HIV and other infections in this region because of the increasing population and persistent high risk of injecting and sexual behaviours. However, observed reduction in HIV prevalence and injection risk behaviour can be taken as some evidence to support the effectiveness of existing prevention and intervention strategies for HIV/AIDS in the past few years. Our results also underscore the urgent need of developing innovative strategies that can improve accessibility of current harm reduction services, especially to certain subgroups such as migrant people, and can incorporate more comprehensive contents including HCV prevention education and other theory-based intervention programs.

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Table 1. Social-demographic characteristics of injection drug users (IDU)

	Weighted %	95%CI
Age		
≤25 years	13.6	(9.6-17.9)
26～35 years	36.7	(30.9-42.4)
＞35 years	49.7	(43.7-56.1)
Male	92.7	(89.3-95.8)
Ethnicity		
Han	45.7	(37.2-53.2)
Others	54.3	(46.8-62.9)
Marital status		
Single	38.4	(32.6-43.8)
Living with a spouse or partner	35.5	(30.2-41.4)
Divorced/separated/widowed	26.1	(21.7-30.9)
Education		
Primary school and below	49.3	(43.2-55.5)
Junior high school	38.9	(32.9-44.9)
Senior high school and above	11.8	(8.7-15.5)
Occupation		
Casual laborer	34.3	(29.2-41.5)
Farmer	38.3	(30.4-45.6)
Others	11.7	(8.5-14.8)

Unemployed	15.6	(11.6-19.0)
Monthly income ≤1500 RMB	65.5	(60.7-70.7)
Residential status		
Local resident	84.9	(80.9-88.4)
Non-local	15.1	(11.6-19.1)
Having a history of incarceration	78.3	(73.3-83.3)

Table 2. Types of drug used in lifetime and the past six months among IDUs

	Lifetime use		Current use	
Drug type	**Weighted %**	**95%CI**	**Weighted %**	**95%CI**
Heroin	100	-	100	-
Alcohol	95.5	(93.6-97.3)	60.1	(54.0-66.1)
Amphetamine-type stimulants (ATS)	84.2	(79.9-89.3)	75.2	(70.0-81.1)
Opium	60.7	(54.8-66.9)	9.3	(5.7-13.3)
Tranquilizers/barbiturates/benzodiazepines	35.4	(30.4-40.6)	22.1	(18.5-26.2)
Other drugs (marijuana, ketamine, Demerol®, cocaine)	12.2	(8.5-16.3)	3.2	(1.3-5.7)

Table 3a. Factors associated with HIV and HCV infections in univariate analysis

	HIV positive			HCV positive		
	weighted%	**OR**	**(95%CI)**	**weighted%**	**OR**	**(95%CI)**
Age						
≤25 years	6.4	1		30.3	1	
26～35 years	23.4	1.19	(1.05-1.35) [c]	48.0	1.19	(0.97-1.45)
＞35 years	17.8	1.13	(1.02-1.25) [c]	40.0	1.12	(0.93-1.35)
Having a history of incarceration						
No	6.0	1		30.8	1	
Yes	21.8	1.17	(1.08-1.27) [c]	44.5	1.16	(0.99-1.34) [b]
HIV positive						
Negative	_			32.3	1	

Positive				83.6	1.67	(1.42-1.95)	c
HCV positive							
Negative	5.2	1		_			
Positive	37.1	1.37	(1.23-1.52)	c			
Syphilis positive							
Negative	17.4	1		41.0	1		
Positive	34.3	1.21	(0.99-1.48)	b	54.7	1.13	(0.92-1.40)
Duration of injection drug use							
≤5	5.7	1		33.8	1		
＞5	32.1	1.14	(1.04-1.24)	c	51.0	1.2	(1.05-1.36) c
Number of drugs injected							
1	12.3	1		34.6	1		
≥2	28.2	1.17	(1.05-1.30)	c	53.2	1.21	(1.06-1.37) c

Sharing needle/syringe							
No	7.4	1		36.5	1		
Yes	47.5	1.5	(1.31-1.71) [c]	53.5	1.22	(1.05-1.42) [c]	
Sharing other injection equipment							
No	14.8	1		30.6	1		
Yes	21.0	1.07	(0.97-1.18)	47.7	1.19	(1.05-1.35) [c]	
Frequency of injection drug use [a]							
Monthly/weekly	8.8	1		29.4	1		
Daily	20.3	1.12	(1.01-1.23) [c]	43.9	1.17	(1.01-1.36) [c]	
Receptive needle/syringe sharing [a]							
No	15.3	1		38.3	1		
Yes	47.5	1.39	(1.17-1.66) [c]	74.2	1.43	(1.22-1.66) [c]	
Injection with a previously self-used needle/syringe [a]							

No	8.6	1			32.2	1		
Yes	24.4	1.17	(1.07-1.28)	[c]	46.8	1.18	(1.03-1.35)	[c]
Having unprotected sex with regular sex partner [a]								
No	19.4	1			10.0	1		
Yes	12.1	0.93	(0.74-1.18)		40.8	1.42	(1.24-1.63)	[c]
Having unprotected sex with non-regular sex partner [a]								
No	8.2	1			33.2	1		
Yes	18.9	1.31	(1.05-1.64)	[c]	52.1	1.17	(0.85-1.62)	

[a] Past 6 months

[b] $p < 0.1$

[c] $p < 0.05$

Table 3b. Final model showing association of factors with HIV and HCV sero-prevalence among IDUs

	AOR	(95%CI)	*P* value
HIV infection			
HCV positive	1.29	(1.17-1.43)	＜0.001
Duration of injection drug use ＞5 years (ref.≤5)	1.25	(1.13-1.39)	＜0.001
Shared needle/syringe (lifetime)	1.45	(1.27-1.65)	＜0.001
HCV infection			
HIV positive	1.59	(1.36-1.87)	＜0.001
Number of drug types injected ≥2 (lifetime)(ref.1)	1.14	(1.01-1.29)	＜0.05
Shared other injection equipment (lifetime)	1.15	(1.03-1.30)	＜0.05
Had unprotected sex with regular sex partner (past six months)	1.44	(1.23-1.68)	＜0.001

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