

**NATIONAL HIV/AIDS SECOND  
GENERATION SURVEILLANCE ON  
DRUG USERS IN 2005 IN CHINA**

Dissertation Submitted From  
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In Fulfilment of the Requirements for the Academic Degree  
Doctor of Public Health (DrPH)

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June 2007  
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*To my parents*

*“Of all the forms of inequality, injustice in health care is the most shocking and inhumane.”*

--- Martin Luther King, Jr.

## ***Acknowledgment***

At first, I would especially thank those scientific workers, researchers and other relevant organisations who worked in the field of HIV/AIDS, without their published excellent documentary works, I can not write this paper at all.

I would also like to thank Prof. Dr. Alexander Krämer, my supervisor, for his constant scientific support and his many stimulating suggestions during this work, especially, for his gentleness, patience and unprejudiced attitude. My thanks also go to Dr. Rafael Mikolajczyk, Dr. Mirjam Kretzschmar, Ms. Regina Myska, and the members and students of the Section of Human Medicine, School of Public Health at the University of Bielefeld for providing many valuable comments and technical and moral support during my study in Bielefeld. I'd like to thank all members of the School of Public Health for the scientific atmosphere and friendly environment.

Pparticularly, I would like to thank Prof. Dr. Fan Lu, head of unit epidemiology, China CDC AIDS/STD Center, for providing me such an opportunity that I could conduct my dissertation in China CDC under a scientific, friendly and international atmosphere. My thanks also go to the whole members of unit epidemiology, China CDC AIDS/STD Center, Prof. Shuquan Qu, Prof. Lu Wang, Prof. Yanling Chen, Dr. Dongmin Li, Dr. Liyan Wang, Dr. Yanhe Wang, Dr. Dapeng Zhang, Ms. Qianqian Qin, Ms. Lan Wang, Ms. Zhenxia Yang, Mr. Gang Zeng, Mr. Fei Jiang, Mr. Gaoxin Zheng, Mr. Houlin Tang, Mr. Dongpeng Liu, Ms. Chaghanhua (Ningxia CDC), Dr. Jinkou Zhao (US CDC China Office), for their generous help and friendship during my stay there, I appreciated their technical support and professional advice for my dissertation. I thank Dr. Nimako Sarpong, Mr. Ariya Bunngamchairat, and Ms. Maya Nikolova for editing my English in the dissertation. I would also like to give my thanks to my friends in Germany and China that I could not list every one's name here, for their generous friendship and support.

I am grateful to my family for their patience and love. I cannot thank them enough for what they have done for me. Without them this work would never have come into existence.

# Contents

<i>Acknowledgement</i>	<i>iv</i>
<i>List of Abbreviations</i>	<i>vii</i>
<i>List of Tables and Figures</i>	<i>viii</i>
Chapter I Introduction	1
1.1 HIV/AIDS Global Trend	2
1.2 HIV/AIDS Epidemic in China	7
1.3 HIV/AIDS Surveillance	19
1.4 HIV/AIDS Surveillance in China	24
1.5 Drug Users in China	29
1.6 HIV Epidemic in Yunnan Province	34
Chapter II Objective and Methodology	39
2.1 Objective	40
2.2 Methodology	41
Chapter III Results	49
3.1 Sample Characteristics	50
3.2 Sample Characteristics in Different Geographic Regions	60
3.3 Sample Characteristics in Different HIV Prevalence Regions	65
3.4 Bivariate Analysis of Sample Characteristics and HIV and Syphilis Infection	69
3.5 Logistic Regression of Sample Characteristics and HIV and Syphilis Infection	73
3.6 Sample Characters of Higher HIV-1 Prevalence Sites in Higher HIV-1 Prevalence Regions	77
3.7 Sample Characters of Higher Syphilis Prevalence Sites	82
Chapter IV Discussion	87
4.1 HIV/AIDS Among Drug Users in China	88
4.2 HIV Transmission Through “Bridge Population” From Drug Users to General Population	95
4.3 Intervention Strategy on Drug Users in China	100
4.4 Use of Surveillance Data	103
4.5 Limitation of HIV Surveillance and Limitation of This Study	106

4.6 AIDS Policy in China	113
Chapter V Conclusion	120
<i>References</i>	<i>126</i>
Appendix	141
Summaries	145
Erklärung	158

## List of Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
CDC	Centres for Disease Control and Prevention, USA
China, CDC	China Center for Disease Control and Prevention
CNY	China Yuan (Chinese Currency; RMB 7.75Y~1\$)
DPA	Deutsche Presse Agentur
EuroHIV	European Centre for the Epidemiological of AIDS
FHI	Family Health International
FSW	Female Sex Workers
HIV	Human Immunodeficiency Virus
IDU	Injecting Drug User
MOH	Ministry of Health, China
MSM	Men have sex with men
NCAIDS	China CDC, AIDS/STD Center
NIDA	National Institute on Drug Abuse
NGO	Non-Government Organisation
NNCC	National Narcotic Control Commission
PCRS	Partner Counseling and Referral Services
PRC	The People's Republic of China
SFPC	State Family Planning Commission, China
STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Infections
TB	Tuberculosis
UN	The United Nations
UNAIDS	The Joint United Nations Programme on HIV/AIDS
UNDP	The United Nations Development Programme
VCT	Voluntary Counselling and Testing
WHO	World Health Organisation

# List of Tables and Figures

## List of Tables

Table 1.1: The number of adults and children infected with HIV during 2005	3
Table 1.2: HIV/AIDS epidemiological situation in China	7
Table 1.3: Adult HIV data and estimates for China (1990~2005)	14
Table 1.4: Provinces and sites with highest HIV infections rates among IDU (2000)	33
Table 3.1: HIV prevalence in surveillance sites	54
Table 3.2: HIV prevalence in surveillance sites	55
Table 3.3: Regional GDP per capita 2004	56
Table 3.4: HIV prevalence and surveillance sites in sub-region	57
Table 3.5: Prevalence of HIV and syphilis in target populations	58
Table 3.6: Demographic characteristics of the surveillance samples in different geographic regions	61
Table 3.7: Drug using behavioral characteristics of the surveillance samples in different geographic regions	62
Table 3.8: Sexual behavioral characteristics of the surveillance samples in different geographic regions	63
Table 3.9: Other characteristics of the surveillance samples in different geographic regions	64
Table 3.10: Demographic characteristics of the samples in different HIV prevalence regions	66
Table 3.11: Risk behavioral characteristics of the samples in HIV prevalence regions	67
Table 3.12: Other characteristics of the samples in different HIV prevalence regions	68
Table 3.13: Bivariate analyse of demographic and socio-economic characteristics of the samples in relation to HIV infection	70
Table 3.14: Bivariate analyse of behavioral characteristics of the samples in relation to HIV infection	71
Table 3.15: Bivariate analyse of demographic and behavioral characteristics of the samples in relation to syphilis infection	72
Table 3.16: Logistic regression analysis of the socio-demographic factors associated with HIV <sup>+</sup>	73



Table 3.17: Logistic regression analysis of the socio-demographic factors associated with syphilis	74
Table 3.18: Logistic regression analysis of all factors associated with HIV <sup>+</sup>	75
Table 3.19: Logistic regression analysis of all factors associated with syphilis	76
Table 3.20: Characteristics of samples in Guangxi Nanning, Sichuan Liangshan, and Xinjiang Kashi	78
Table 3.21: Logistic regression analysis of sample characteristics associated with HIV <sup>+</sup> in Guangxi Nanning (HIV-1 prevalence 21.0%)	79
Table 3.22: Logistic regression analysis of sample characteristics associated with HIV <sup>+</sup> in Sichuan Liangshan (HIV-1 prevalence 29.4%)	80
Table 3.23: Logistic regression analysis of sample characteristics associated with HIV <sup>+</sup> in Xinjiang Kashi (HIV-1 prevalence 10.8%)	81
Table 3.24: Characteristics of samples in three higher syphilis sites (Guangxi Nanning, Guangdong Dongguan, and Xinjiang Kashi)	83
Table 3.25: Logistic regression analysis of sample characteristics associated with syphilis in Guangdong Dongguan (syphilis prevalence 9.6%)	84
Table 3.26: Logistic regression analysis of sample characteristics associated with syphilis in Guangxi Nanning (syphilis prevalence 17.5%)	85
Table 3.27: Logistic regression analysis of sample characteristics associated with syphilis in Xinjiang Kashi (syphilis prevalence 10.4%)	86

## List of Figures

Figure 1.1: The geographic distribution of cumulative reported HIV cases in China 1985- 2004	12
Figure 1.2: Annual reported cases of HIV/AIDS in China (1985 - 2005)	13
Figure 1.3: Registered drug users in China (1990-2004)	31
Figure 3.1: The geographic distribution of cumulative reported HIV cases in China 1985- 2004 and sentinel sites among drug users in 2005	48
Figure 4.1: HIV transmission among drug users in China	93
Figure 4.2: Risk behaviours and the potential for HIV spread in China	96
Figure 4.3: The Structure of Chinese Center for Disease Control and Prevention	114

# Chapter I

## INTRODUCTION AND BACKGROUND

*“On current trends, AIDS will kill tens of millions of people over the next 20 years. But this need not happen. We know prevention works. We know that HIV treatment and care work. The global AIDS response is poised to enter a new era: where leadership and commitment are at long last matched with the resources needed to get on with the job.”*

--- Dr. Peter Piot

*(UNAIDS Executive Director and Under Secretary-General of the United Nations)*

After more than 20 years since HIV/AIDS was first recognized in 1981, it seems unnecessary to introduce HIV/AIDS here again, however, an overview of HIV/AIDS global trend will provide a snapshot to understand the epidemic more easily.

## **1.1 HIV/AIDS Global Trend**

Acquired immunodeficiency syndrome (AIDS) is caused by human immunodeficiency virus (HIV) and was first recognized as a new and distinct clinical emerge in 1981 in USA (*Rushing, 1995; UNAIDS, 2005*). The HIV/AIDS epidemic spreads across the globe at an appalling rate, since AIDS was first described. When the epidemic was first described in North America, and soon after in Western Europe, HIV infection was high among gay men and injecting drug users. Heterosexual transmission later becomes dominant in general population in sub-Saharan Africa. Even within continents and countries, different epidemics demonstrate at different rates in different population groups. Another feature of the HIV/AIDS epidemic is the enormous diversity of strains of the virus due to its ability to rapidly mutate. There are two main types of HIV, HIV-1 and HIV-2 (*Curtis, 1992*). HIV-2 infection is predominantly found in Africa. Both HIV-1 and HIV-2 have the same modes of transmission and are associated with similar opportunistic infections and AIDS.

As of today, few diseases have emphasized the interaction between human behavior, community, health and disease as AIDS has done. HIV/AIDS, just with other two major infectious diseases - tuberculosis (TB) and malaria, cause approximately half of infectious disease mortality. These three diseases result in over 300 million illnesses and more than 5 million deaths each year (*WHO, 2000-a*). HIV/AIDS demonstrates an increasing challenge to countries all over the world, both directly as a health issue and indirectly through the challenges they pose for development. AIDS is a critical problem for development because of the number of people and sectors affected. By killing large numbers of productive and reproductive adults, It

also increases the total number of children orphaned by death of one or both parents (Fan et al, 1995).

The epidemic is not homogeneous within regions and within some countries. Even at the country level there are wide variations in infection levels between different areas, sexes and socioeconomic level, such as in China and India. The number of people living with HIV/AIDS continues to rise, but in several countries it is declining. Evidence shows that changes in sexual behavior, such as increased use of condoms, fewer sexual partners and delay of sexual experience, play key parts in these declines. The more current increases have occurred in Eastern Europe and Central Asia (25% increase to 1.6 million) and East Asia (UNAIDS, 2005).

By the end of 2005, 25 million people around the world have already died of AIDS, 4.3 million of them children. Nearly twice that many – 40.3 million - are now living with HIV, and most of these are likely to die over the next decade or so. The Joint United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organisation (WHO) recent estimates showed that, in 2005 alone, 4.9 million people were newly infected with HIV, 3.2 million were in Sub-Saharan Africa and 1,138,200 in Asia and the Pacific (See Table.1.1) (UNAIDS, 2005).

**Table 1.1 The number of adults and children infected with HIV during 2005**

Region	Total of people living with HIV to the end of 2005	Total of newly infected Adults & Children with HIV in 2005
Sub Saharan Africa	25.8 million	3.2 million
Asia and the Pacific	8,344,000	1,138,200
Eastern Europe & Central Asia	1.6 million	270, 000
Latin America and the Caribbean	2.1 million	230, 000
The Middle East and North Africa	510,000	67, 000
High-income countries	1,920,000	65, 500
Total	40.3 million	4.9 million

*Source: UNAIDS 2005*

Today, more than two decades after the first case of AIDS was reported, five people worldwide die of AIDS every minute of every day. HIV has hit every corner of the world, infected more than 40 million men, women and children, 4 million of them in 2005 alone. Ninety-five percent of its victims are residents of the developing world (*UNAIDS, 2002-b*). The need to characterize the complex interaction of psychological and cultural factors that place individuals, families and communities at risk of HIV and AIDS has become urgent.

Africa is the global epicentre of the HIV epidemic, the current data show that 25.8 million adults and children are living with HIV. In 2005 alone, AIDS have caused an estimated 2.4 million African deaths. In addition, at least 95 percent of all AIDS orphans have been Africans (*WHO, 2005*).

Sub-Saharan Africa is the hardest hit region of the world. Sub-Saharan Africa's epidemic is best analyzed under three sub-regions: eastern, southern and western Africa. In East Africa, which has Africa's oldest epidemic, with 15 percent of sub-Saharan Africa's population, this sub region has 38 percent of its HIV infections (*World Bank, 1996; FHI, 2006*). Yet the epidemic has slowed in East Africa. It is spreading much faster in southern Africa, where it was first observed in the early 1980s. In fact, in 1993, WHO stated that the global HIV epicenter had moved from eastern to southern Africa. The turning point was a 1993 survey showed that 37 percent of pregnant women in Francistown, Botswana, were infected with HIV. Southern Africa now has over 40 percent of sub-Saharan Africa's HIV infections and the world's seven most-affected countries: Swaziland, Zimbabwe, Botswana, Zambia, Malawi, South Africa and Namibia. HIV entered West Africa in the early 1980s, but fortunately has spread more slowly there. Fewer than 18 percent of HIV infections are in West Africa, Africa's most populous region (*UN, 2003; WHO, 2000-b*).

In 2001, 70 percent of all people who became infected with HIV, and 80 percent of those who died of AIDS, came from sub-Saharan Africa, even though only a tenth of the world's population lives there. However, the African countries south of the Sahara have some of the best HIV surveillance systems in the world (*UN, 2003*). It showed that the estimated number of newly infected adults and children in Africa reached 3.5 million by the end of 2002 (*UNAIDS, 2003*). While adult HIV prevalence has apparently fallen in Kenya, Uganda and Zimbabwe, the epidemic has yet to peak in several other nations. Women are disproportionately affected.

A few countries have seen recent declines in prevalence, probably in part due to effective prevention campaigns, but elsewhere epidemics are still increasing. The number of Africans living with HIV continues to rise due to general population growth, even though prevalence remains stable. Stabilisation of HIV prevalence occurs when the rate of new infections is equalled by the death rate among the infected population. This means that a country with a stable but very high prevalence must be suffering a very high number of AIDS deaths each year.

To tackle HIV/AIDS in Africa is not an easy work. Many efforts are and will be needed. The long-term planning to slow the epidemic and reduce its impact needs be emphasized. One of the best and easy ways to cope with HIV/AIDS is prevention. Those prevention efforts that work in Africa and individual countries need to be identified and sustained. This also means enabling African people to protect themselves against infection.

The difference of the AIDS epidemic in Asia is even greater than in Africa. Until the late 1980s, no Asian country had experienced a major AIDS epidemic, but by the late 1990s, the disease was well established across the region. The Asia Pacific region is vast and diverse. In addition to countries with varied epidemiological patterns of HIV and AIDS – high versus low HIV prevalence countries and different predominant HIV risk behaviours – countries in the region also have extremely diverse capabilities to develop and support public health prevention and control

programmes. Many Asian countries lack accurate systems to surveillance the spread of HIV. This means that the estimates of HIV infection in Asia are often based on less information than in other regions. The lack of research and information on the nature and linkages between sexual networks in Asian countries also makes it difficult to predict the future course of the HIV epidemic (*UNAIDS, 2002-c*).

In Western countries, AIDS cases have fallen to levels not seen since the original outbreak; many attribute this trend to aggressive educational campaigns, screening of blood transfusion and increased use of condoms. Also, the death rate from AIDS in Western Europe and North America has fallen sharply, as new AIDS therapies have proven to be an effective means of suppressing HIV.

The routes of transmission of HIV are different in Western countries, including commercial sex, MSM, IDU, mother to child and heterosexual sex. However, many new infections in this region occur through contact with HIV-infected individuals from other regions. The adult (15-49) prevalence in this region was 0.3% with between 570,000 and 890,000 people currently living with HIV (*UNAIDS, 2005*). Due to the availability of antiretroviral therapy, AIDS deaths have stayed low.

Latest estimates showed some 8.3 million people were living with HIV in Asia and the Pacific region in 2005, including the 1.1 million people who became newly infected in the past year. AIDS claimed some 520,000 lives in 2005 (*UNAIDS, 2005*). Combinations of risky sexual and drug-use behaviors are speeding the epidemic; authorities worry that current prevention strategies may not take this into account. Half of the world's population lives in Asia, so even small differences in the absolute numbers of people infected, can make huge differences in the infection rates.

## **1.2 HIV/AIDS Epidemic in China**

In 1985, a foreign tourist visiting southeast China became the first person in the country to be diagnosed with AIDS (*Yuan & Li; 1997*). Since the first detected case in 1985, the epidemic has been expanding continuously (See Table.1.2). By March 1999, the cumulative reported number of people living with HIV/AIDS reached 13,051, with a total of 419 AIDS cases and 226 AIDS-related deaths. As of 30 September 2001, MOH reported a total of 28,133 people infected with HIV, of whom 1,208 had developed AIDS and 641 died (*MOH, 2002*). Up to the end of 2005, the cumulative HIV-1 positive reported number was 141,241, with a total of 32,244 AIDS cases and 7,933 AIDS deaths (*MOH, 2006*).

**Table 1.2 HIV/AIDS Epidemiological Situation in China**

<i>Cases</i>		<i>Year</i>
Year AIDS first reported:		1985
Reported cumulative AIDS cases:	32,244	2005
Reported cumulative AIDS deaths:	7,933	2005
Reported cumulative HIV+:	141,241	2005
Official estimates of current HIV +:	650,000	2005

*Source: MOH, China*



China's HIV/AIDS epidemic is associated with illiteracy, poverty, population mobility, and gender inequality. Both prostitution and drug abuse boomed in the mid-1990s accompanying with the economic reform. The sharing of contaminated needles among injecting drug users is the most frequent mode of transmission of reported HIV-1 infections in China. The worst affected provinces tend to be along drug trafficking routes, especially the areas bordering the Golden Triangle. Both heterosexual and homosexual transmissions of HIV are also increasing. A vast migrant population of between 80 and 120 million people are moving away from home in search of better jobs and income, providing fertile ground for HIV's spread (*Anderson et al, 2003*). Migration, economic disparity, and poor knowledge of AIDS are important factors driving the epidemic, particularly among commercial sex workers. There are an estimated four to six million commercial sex workers in China, and condom use is relative low (*Abrams, 2001*). China's illegal blood trade has fuelled HIV/AIDS among the country's rural populations (*Beach, 2001*).

The HIV/AIDS pandemic continues to spread around the world at an alarming rate, and the number of people living with HIV will grow significantly by the end of the decade, as it becomes more geographically diverse. HIV/AIDS have also been spreading at an alarming rate in China, though the estimated adult prevalence rate of HIV/AIDS is still low (<0.1%) (*MOH, 2006*). However, considering only the overall national HIV prevalence can give misleading impressions, especially in countries with very large populations - like China and India - China is a country with an overall low HIV prevalence and concentrated epidemic in focused areas and focused groups of people, where millions of people can be affected while the prevalence in some groups is very high despite low national prevalence rate. While national scientifically valid data on current estimates and future trends remain incomplete, many national and international experts estimate that there were over one million HIV infections in China in 2001 (*WHO, 2002*). The overall figure of reported HIV infections remains relatively low, and is concentrated in particular regions, the majority of them is in rural area. However, the routes of transmission now cover

broad areas of the country.

HIV/AIDS epidemic in China can be divided into four phases. The first phase, in 1985~8, the first diagnosed case of AIDS was reported in 1985, included a small number of imported cases in east coast cities - mostly foreigners and overseas Chinese. Four haemophiliacs from Zhejiang province also got infected with HIV-1 after using imported factor VIII. In 1987, China reported its first AIDS-related death of a Chinese person contracting AIDS in China. The victim was a 13-year-old haemophiliac boy who contracted AIDS from imported blood products (*Xinhua, 1987*). In the same year, China reported its third AIDS-related death, a resident of Fujian province who had lived in Hong Kong and New York (*Southerland, 1987*).

The second phase, from 1989 to 1993, began with finding HIV-1 infection in 146 drug users among minority communities in Yunnan province in the south west, bordering to the “Golden Triangle”. In November 1990, China announced the death of two Chinese men from AIDS. One of these men was a drug addict from Yunnan, and the other was a Beijing resident who contracted HIV-1 through sexual intercourse while traveling abroad (*Toronto Star, 1990*). Since 1985, China has confirmed that 446 people have contracted the HIV virus, of which 378 were Chinese. Some 368 of the Chinese carriers were from Yunnan.

The HIV/AIDS case rate in China increased 117% over the period 1990-1992, from 446 to 957 HIV infections. While the majority of cases in 1990 were localized in Yunnan among minority farmers, infection was found in 19 provinces, counties, and urban areas over a wider spectrum of society in 1992 (*Gil, 1993*). By the end of 1993, Chinese health officials has reported that 1,159 people have tested positive for HIV, and at least 19 now have full-blown AIDS (14 AIDS patients have died) (*MOH, 1995*).

The third phase was from 1994 to 1998, when a number of infections was reported among drug users and commercial plasma donors. Later, the virus spread beyond Yunnan and moved into Sichuan, Xinjiang and Guangxi. At the same time, the

number of reported cases for the whole country rose by 30%. Up to May of 1994, China reported 1,361 HIV carriers (of whom 255 were foreigners or foreign citizens of Chinese origin and 1,106 were Chinese), and 40 AIDS patients. These HIV positives and AIDS patients were found in 22 provinces and cities, including Yunnan, Guangdong, Beijing, Shanghai, Fujian and Zhejiang, with more than 85 per cent of the HIV positives in Yunnan Province (*MOH, 1995*). Before 1989, the persons infected with the HIV virus had been mainly people from abroad, but thereafter the incidence of mainland HIV carriers rose at a rapid speed.

By 1998, HIV-1 infection had been reported from all 31 provinces, autonomous regions, and municipalities (*Zhang & Ma; 2002*). Underreporting was probably high; the estimated actual number of HIV-infection cases throughout the country may exceed 300,000 in 1998. A survey (*Zhu, 1998*) indicated that 89% of HIV-infection cases were men; 11% were women. The age distribution was as follows: 51% were 23 or younger; 40% were between the ages of 24 and 32; and 8.4% were age 33 or older. 70% living in large cities; 21% living in medium size cities; and 9% living in towns (*MOH, 1998*).

From 1999 to the present is the fourth phase of HIV epidemic in China, during this period, the number of reported cases for 2000 was 37.3% higher than the numbers for 1999. This indicates that the virus spreads more quickly and in some regions of China, e.g. Yunnan, the epidemic has moved into a critical phase.

HIV/AIDS in China began as a highly localized and largely rural problem in Yunnan Province. From 1985 through 1994, However, HIV-1 infection and AIDS have become an emerging urban problem (*Yu et al, 1996*). Since 1997, China has moved from predominantly HIV epidemic among IDUs to a country facing a massive explosion of HIV. It has spread along the various trafficking routes and has now transmitted into areas that were previously unaffected. In 2000, 70% of all HIV cases are due to IDU (*MOH, 2001-b*).

The highest prevalence rates have been reported in Yunnan, Xinjiang, Guangxi, and Sichuan, all western and southern provinces that locate on the drug route. UNAIDS reported “prevalence rates higher than 70 percent among injecting drug users in areas such as Yili Prefecture in Xinjiang and Ruili County in Yunnan.” (*UNAIDS, 2002-a*). These statistics show the seriousness of the epidemic in these areas.

An estimated 400,000 persons were living with HIV in 1998. The prevalence rate among people aged 15 to 49 years was less than 0.1%. However, only about 5% of estimated HIV/AIDS were reported (*WHO, 1999*). By March 1999, the cumulative reported number of people with HIV/AIDS reached 13,051, with a total of 419 AIDS cases and 226 AIDS-related deaths. As of 30 September 2001, MOH reported a total of 28,133 people infected with HIV, of whom 1,208 had developed AIDS and 641 died (*MOH, 2002*).

In 2002, HIV/AIDS epidemic increased continuously, the national report on HIV/AIDS were 9,824, compared in 2001 a rise 19.5 %. Full-blown AIDS cases were 1,045, compared in 2001 an increase of 46.4%, 363 died. By the end of 2002, the national accumulative reported HIV/AIDS were 40,560 (*MOH, 2003*). HIV and AIDS have been spreading at an alarming rate in China, and it shows a big different geographic distribution of the accumulative number of HIV infection . (Figure 1.1)

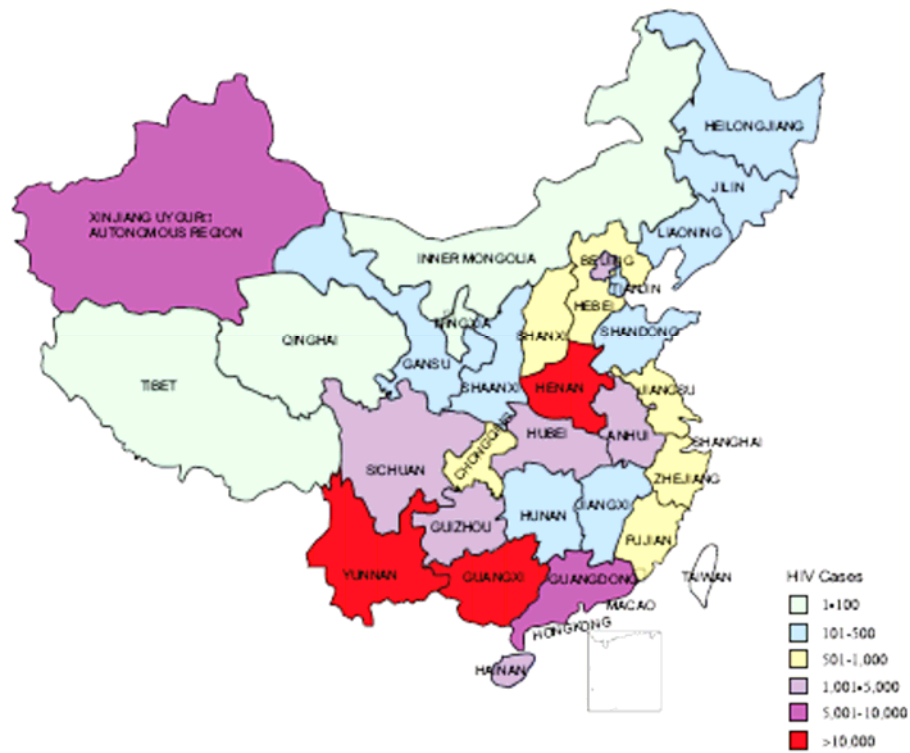


Figure 1.1 The geographic distribution of cumulative reported HIV cases in China 1985- 2004

source: WHO: *A Joint Assessment of HIV/AIDS Prevention, Treatment and Care in China (2004)*

By the end of 2005, MOH reported accumulative total number of 141,241 people infected with HIV, of whom 32,244 had developed AIDS and 7,933 died (Figure 1.2). The Chinese government currently estimates up to 650,000 Chinese citizens may be infected with HIV (MOH, 2006).

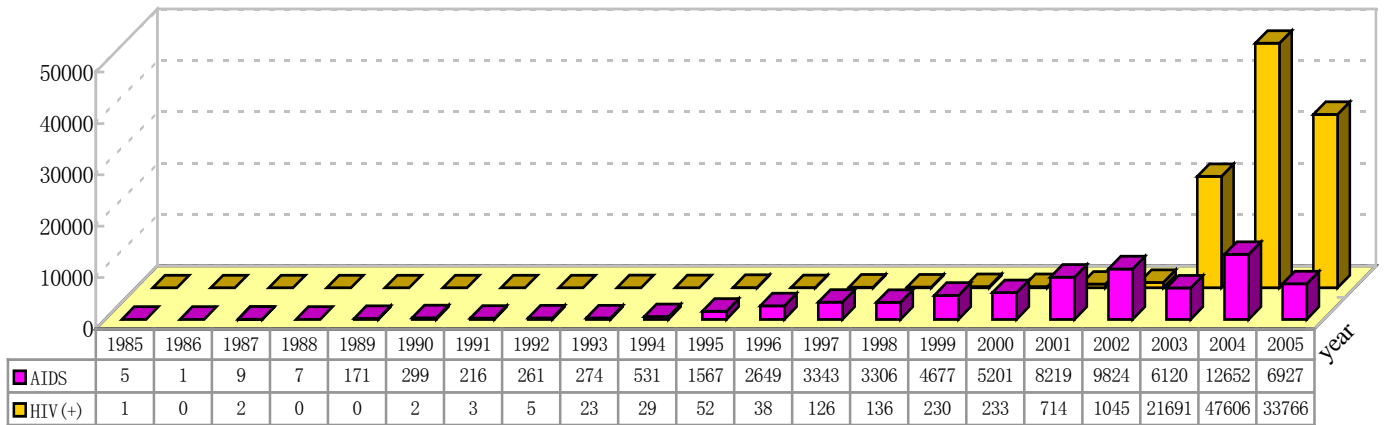


Figure 1.2 Annual Report HIV/AIDS in China (1985~2005)

Source: MOH, China

In August 2001, the Chinese Government finally admitted that the country was facing a serious AIDS crisis. Previously, the Chinese Government did not like recognizing this problem because of the social value and ideology, and the extent of the Chinese epidemic had been unknown. Now government officials estimate that the total number of people infected with HIV is around 650,000 (MOH, 2006). The ratio of male to female HIV prevalence was 9/1 between 1991 and 1995, and 4/1 in 2001, the number of female HIV prevalence has been increasing continuously (See table 1.3).

**Table 1.3 Adult HIV data and estimates for China (1990~2005)**

	1990- 1995	1996- 1997	1998- 1999	2001	2003	2005
Estimate total adult HIV (thousand)	10	100	500	800- 1,500	840	650
Adult HIV prevalence	<0.002%	<0.02%	<0.1%	<0.2%	<0.1%	0.05%
Male/Female ratio	9:1	7:1	5:1	4:1	1.5:1	1.5:1
Male HIV prevalence	<0.01%	<0.05%	<0.2%	<0.5%	/	/
Female HIV prevalence	<0.001%	<0.01%	<0.02%	<0.01%	/	/

*Source: MOH, China, State Council*

Unlike in other developing countries, centralism is the major characteristics of Chinese politics, in the field of economy, the major challenges are associated with a transition from a centrally planned economy to a market economy and from a rural to an urban economy and with social changing (*UNDP, 1999*). These changes have also been associated with changes in social values and HIV-risk behaviours; social, cultural factors have influence on the behaviour that is at the central point of HIV transmission. These factors explain why there are significant differences among different population groups at the level of HIV prevalence and the rate of its transmission. The emergence and wide spread of HIV in China can be well understood in the context of the country's socio-economical changes, which have played a role on behaviours such as the use of injectable drugs and prostitution, STDs are exponentially increasing throughout the country as well.

Especially, a growing floating population is also a main factor in the increase and spread of socially changing and epidemiological high-risk behaviour in China (*Thomas, 1998*). A number of factors make migrant workers particularly more vulnerable to HIV infection. Migrant workers are often young, lower educated, and living for a long period away from their families and communities. They are often unmarried or live apart from their spouses and children. They tend to have more available cash money than they were used to having in rural areas. All these factors make them likely to have sexual interaction with casual partners, in some cases with

commercial sex workers.

HIV has always been associated with the movement of people. Migration makes personal contact more easily and mixes different population groups together, which provides a loose environment for viral transmission. Through the movement of infected persons, migration can also offer a easy way to transport diseases to places where they are previously virgin. Population mobility is not only a transporter of HIV; it also causes broader social and behavioural changes that make transient migrants particularly susceptible to HIV infections (*Yang, 2001*).

Injecting drug use is the major mode of HIV infection in China. It accounts for about 70% of total reported cumulative HIV infections. Transmission of HIV through blood and blood products and plasma donation was also a severe problem in China in a special period in 1990s. In recent years, the number of HIV infections caused by heterosexual contact is increasing. In general, the infection rate through sexual transmission is still low, but the rate of increase for annual reported STD was about 30%. In 1999, 837,357 STD cases were reported (*Gong et al, 2000*). The actual number of new STD cases was estimated at about six millions people and it is estimated that sexual transmission will become the major mode of HIV transmission among the general population in the future.

The HIV/AIDS epidemic in China has the following characteristics.

- The spread of the epidemic is fast. Since 1995, the spread of the HIV/AIDS has speeded and the newly discovered HIV positives increased by 30 per cent per year in 1995-2000 (*MOH, 2001-a*).
- The HIV/AIDS epidemic is more serious in the rural regions. The HIV/AIDS epidemic has spread to all provinces, autonomous regions and municipalities of China and the worst cases are found in the west and south-west areas where socio-economical level is very low in comparison to other regions in China. Among the 10 provinces and regions where the HIV/AIDS prevalence rates are the highest, 7 are in the economically underdeveloped regions in the middle and western parts of China. It is estimated that 80 per



cent of the infections are in the rural areas (*MOH, 2006*).

- People at young ages are threatened by this epidemic most severely. Among the HIV/ AIDS cases in China, more than half of them (51.9%) are aged 20-29; the next is the age group 30-39, 30.6 per cent. These two age groups together comprise of 82.5 per cent of all HIV/AIDS infections (*SFPC, 2002*).
- The main channel of infection is the intravenous drug injection, but infections through sexual transmission are also on the rise. In 2000, the proportion of infection through intravenous drug injection was 66.5 per cent of the total reported cases, slightly lower than that in 1999 (*MOH, 2001-b*). In 2005, the epidemic data showed, 44.3% of HIV infection was through IDU, and 43.6% was through sexual transmission (*MOH, 2006*). Infections through sexual transmission are clearly rising.

China has made remarkable achievements in improving the health status of its population since 1949 (*Abrams, 2001*). These achievements were made much faster than the rate of economic growth and with far less resources than most countries. However, there is good evidence that this progress has slowed since early 1980s, despite accelerating growth of the economy and personal income levels. Furthermore, the discrepancy in health status between the richer coastal areas and the poorer inland provinces has become worse. At the same time, the country is now facing newer health problems including those associated with economic growth and breakup of former national social insurance system.

It is extremely difficult to project the future trend of the HIV/AIDS epidemic in China which has such a huge population, as well as the big difference between the rural areas and the urban cities and reliable statistic data on HIV/AIDS are difficult or impossible to get. UNAIDS maintains the most comprehensive databases of information in the world on AIDS, but the UN organization relies on official government statistics from every single country—which experts believe sometimes understate the number of infected people (*UN, 2003*). Whatever the number of people with HIV finally reached in China, it can be expected that there will be a corresponding explosion in the number of people with AIDS in future years, since

AIDS cases are actually corresponding to the number of HIV infections of five to ten years earlier. Similar epidemic increases can be expected in the diseases closely associated with HIV infection and AIDS, such as TB and other opportunistic infections.

Increasing rate of HIV infections among commercial sex workers in several provinces, many of whom inject drugs, is beginning to form a bridge to the general population, added by low condom use and little knowledge of HIV/AIDS. The rapid rise of commercial sexual behaviour and sexual transmitted diseases not only negatively impacts the physical and mental health of young women, but also helps the transmission of HIV. Simultaneously, after a quasi-absence during some 20 years since 1960s, STDs are recognized again as a growing public health issue in China. In fact, STDs are increasing rapidly throughout the whole country. Gonorrhoea remains the most prevalent STD, but syphilis, condyloma acuminatum, and nongenital urethritis are also on the increase. STDs today constitute a major public health problem in China. This resurgence accompanies by the marketing economy, the breakdown of the national health insurance system, the return of prostitution, and other factors (*Abrams, 2001*).

The current rapidly increase in STD numbers is clearly an indicator for the increasing risk of sexual transmission of HIV. Of particular importance is the seriousness of the STD epidemic in a number of provinces in southern China. In Fujian, Guangdong and Hainan, syphilis is spreading fast, with reported numbers quadrupling yearly since 1994. For instance, in Guangdong, reported STDs have increased from 77,728 to 90,066 from 1994 to 1996. The reported syphilis increased from 286 in 1994 to 4,179 in 1996 and to 7,001 in 1997 (*MOH, 1996, 1998*). According to surveys of customers of prostitutes done in Yunnan, no HIV infected patient was found between 1995 and 1997. A cohort study showed that HIV prevalence among spouses of HIV infected persons increased from 3.1% in 1990 to 12.3% in 1997 (*MOH, 2000-a*). Increasing rate of HIV infections among commercial sex workers in several provinces, many of whom inject drugs, is beginning to form a bridge to the general population, accompanied by low condom

use and lack knowledge of AIDS.

Due to widespread drug use and commercial sex, China is still facing an increasing danger of HIV/AIDS epidemic (*UNAIDS, 2002a*). China needs to spend more money and effort in HIV/AIDS prevention and control in order to avoid heavy economic losses due to a widespread epidemic. The spread of AIDS will not only cause the increasing of medical fees, expenditure on preventive campaigns and the cost of labour loss, but also slowdown of the national economy. Now China must consider the AIDS issue from the perspective of the whole national development.

It is clear China now faces a large, rapidly growing and more complex HIV/AIDS problem that carries potential risks for the country's future development. HIV/AIDS has spread from China's borders to inland areas, and from rural to urban, and again from urban to rural areas. The majority of HIV infected persons and people around them, however, does not know their HIV status. It is urgent to take action now; otherwise this opportunity to control the AIDS epidemic in China will be lost.

### **1.3 HIV/AIDS Surveillance**

Surveillance refers to a number of different systems used to track the incidence (new occurrences) and prevalence (total existing cases) of a particular disease. Incidence and prevalence are two basic epidemiological definitions used to explain the extent of particular disease. HIV surveillance is the systematic collection of information on the occurrence, distribution and trends of HIV infection among specific population groups on an ongoing basis. Policies and programs concerning the accessibility and requirements for HIV testing are also a part of surveillance. Continual HIV surveillance data provide useful information to estimate HIV prevalence in select populations, to monitor trends in HIV prevalence in these populations, and to guide and evaluate the planning and implementation of HIV/AIDS prevention and intervention programmes (*UNAIDS/WHO, 2000*).

Since the first emerge of HIV/AIDS, HIV/AIDS surveillance has branded with complexity, with advocates, public health officials, and government agencies often differ on such issues such as reporting for HIV infection, contact tracing, and testing of pregnant women. Now, HIV surveillance becomes a core function of national HIV/AIDS programmes. Surveillance data on HIV infection are important for various reasons, but most importantly to trace the spread of HIV both within different populations in countries as well as across different geographic regions (*WHO, 1988*). Accurate data are not needed for most purposes, as long as the general trends and the extent of magnitude of the existing infection can be measured; and sometimes, it is really hard to get precise data. However, for some purposes, such as measuring the impact of specific interventions, or for testing the efficacy of vaccines and treatments, precise data must be obtained.

AIDS cases reporting has been used as the primary AIDS surveillance tool since the epidemic was identified in 1981 in USA. WHO has requested countries to submit regular reports on cases of AIDS since then (*WHO, 1988*). Updates on aggregated information by sex, age and presumed mode of transmission are collected in a yearly round. The reported AIDS figures give a useful general overview but cannot be assumed to give an accurate or strictly comparable picture of the epidemic in different countries, because the method used to detect, diagnose, and report of AIDS is not universal even in the same country. Almost all countries have set AIDS case-reporting systems now, but the quality of the AIDS case reports varies significantly. The considerable variation in the percentage of AIDS cases that are reported to WHO from different countries reflects differences in the quality and extent of available services and testing facilities and the extent to which the population has access to and uses the facilities, it is also co-related with local socio-economic status.

HIV sentinel surveillance is the main epidemiological tool used to monitor trends in HIV infection prevalence in various population groups. This is HIV screening of selected population groups in the population, including those who are easily accessible, such as pregnant women (whose blood is routinely taken for other reasons ) and people thought to be at high risk of HIV infection. This may include men who have sex with men (MSM), injecting drug users (IDUs), sex workers and people attending sexually transmitted infections (STI) clinics. Surveillance is usually conducted repeatedly at the same sites at regular intervals (serial surveillance) to indicate how levels of infection are changing over time in specific areas and certain population groups. HIV prevalence in the general population and among those at lower risk is also important indicator of the parameters of the epidemic. HIV sentinel surveillance can provide more accurate indications of trends of HIV infection in the selected population groups and sites, particularly when conducted regularly at yearly intervals. HIV sentinel surveillance is a relatively simple and cheap epidemiological tool. Its flexibility and low cost make it feasible and sustainable even in resource poor areas.

The UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance has developed coding schemes to represent four dimensions related to the quality of surveillance systems (*Walker et al, 2001; Garcia-Calleja et al, 2004*):”

- Frequency and timeliness of data collection;
- Appropriateness of populations under surveillance;
- Consistency of the sites/locations and groups measured over time; and
- Coverage/representativeness of the groups for the adult populations.”

The coding schemes depend on the different level of the HIV epidemic in a country. The levels are defined as generalized, concentrated and low according to the HIV prevalence in general population and in defined risk population groups.

Case report, contact tracing and testing of pregnant women and infants comprise of American HIV surveillance system (*Collins, 2001*). States report the names and demographic information of people diagnosed with AIDS to the federal Centers for Disease Control and Prevention (CDC) since the beginning of epidemic, where national figures on the AIDS epidemic are tracked. Though AIDS surveillance is often referred to as the "gold standard" for HIV/AIDS surveillance, it is nonetheless also recognized as an incomplete representation of the epidemic in America. Newly diagnosed cases of AIDS can only state when people are transitioning from asymptomatic HIV positive to full-blown AIDS. Information about the incidence of new infections could not be obtained by AIDS case reports.

HIV incidence information could greatly help prevention planners to allocate prevention resources and target risk population groups. Contact tracing is a traditional public health tool used to identify and contact individuals who may have been exposed to an infectious agent, such as HIV or other STDs. In 1998, CDC issued guideline on HIV partner counseling and referral services (PCRS). It defined the goals of PCRS as providing services to HIV-infected persons and their sex and needle-sharing partners so they can avoid infection, or, if already infected, preventing transmission to others, and helping partners gain earlier access to counseling, testing, medical evaluation, and treatment. Test of pregnant women and

infants is a routine component of prenatal care. Women are informed that a HIV test is being conducted and they would retain the right to refuse to be tested.

HIV infection is also an important public health issue in Europe, though HIV prevalence in most west European countries is very low, evidence shows that sexual transmission of HIV is increasing in many western and eastern European countries. AIDS reporting has been the principal means of monitoring the HIV/AIDS situation in Europe since 1989 (*EuroHIV, 2004,2005*). HIV reporting was set up at the European level in 1999, although it has existed in most west European countries since 1980s. Anonymous individual data on AIDS and, if available, new HIV diagnoses, and data on HIV prevalence in various populations are reported from the 51 countries of the WHO European Region to EuroHIV. EuroHIV Data are presented after grouping the 51 countries into three geographic areas: the West, Center, and East. At middle of 2005 (*EuroHIV, 2005*), in the West, AIDS incidence continued to decline except among those infected heterosexually; numbers of newly diagnosed HIV infections are relatively stable, but rising among heterosexually infected persons, many of whom originate from countries with generalized HIV epidemics. In the East, numbers of newly diagnosed HIV cases (mostly IDUs) continue to rise steeply, particularly in the Russian Federation, Latvia, and Estonia (*EuroHIV, 2005*). In the Center, levels of HIV and AIDS remain low.

HIV/AIDS case reporting is becoming a core element of HIV/AIDS surveillance in Europe. However, at the European level, data standardization is still a challenge because various health care systems between European countries and different HIV testing and surveillance systems. Efforts should be made to use surveillance data for evaluating the effectiveness of HIV/AIDS prevention and intervention programmes.

Globally, sub-Saharan Africa is the hardest hit region. In the fact, all countries in the WHO African Region have generalized epidemics, which are defined as HIV prevalence is equal or over 1% of pregnant women attending antenatal clinics in the urban areas. Ironically, sub-Saharan Africa has some of the best HIV surveillance systems in the world. HIV sentinel surveillance systems have been built in the early

1980s (*WHO, 2001-b*). About 70% of the countries in the region are implementing HIV sentinel surveillance systems with pregnant women attending antenatal care clinics (ANC attendees) being the main sentinel population, because HIV epidemic is already generalized there and the major mode of HIV transmission is heterosexual contact. Pregnant women are set as reference group, because pregnant women are sexually active, constitute an easily definable, accessible and stable population, and are fairly likely to represent the general population. Other sentinel populations that have been used are STI clinic attendees and TB patients. Surveys are conducted once a year or once every two years.

HIV sentinel surveillance data have used to map the epidemic and monitor HIV infection trends in countries in the region as well as serving as an advocacy tool. To some extent, countries have evaluated sentinel data for planning and evaluating HIV interventions. While sentinel surveillance may help to map and determine levels of infection, it does little to explain the current trends, so that second generation surveillance was recommended by UNAIDS and implemented (*UNAIDS, 2002-d*). Compare to previous sentinel surveillance that only focus on HIV sero-prevalence, HIV/AIDS second generation surveillance combines HIV sero-surveillance and behavior surveillance.

Countries are being encouraged to strengthen the existing HIV sentinel surveillance systems and linking the system with behavioral surveillance, using population based HIV prevalence surveys to calibrate and complement the systems.



## **1.4 HIV Surveillance in China**

HIV surveillance system in China mainly includes HIV/AIDS case reporting system and HIV sentinel surveillance system, there are also a number of special studies focusing on HIV infection related behaviours as supplement (*CDC, China/CDC; 2002*). HIV/AIDS reporting was set up at the national level since 1985. In 1985, a foreign tourist visiting southeast China became the first person in the country to be diagnosed with AIDS (*Yuan & Li; 1997*). The official notification of HIV/AIDS cases became a legal requirement in 1989 (*NCAIDS, 2004*). HIV/AIDS case reporting is a passive HIV surveillance tool, the reported AIDS figures give a useful general overview but cannot be expected to give an accurate picture of the epidemic in different regions and in different population groups. With the advent of powerful new AIDS treatments, called highly active anti-retroviral therapy (HAART), the limits of AIDS reporting became even more significant. With increasing numbers of people receiving early treatment for HIV and slow the progression to AIDS, reporting of AIDS cases became an increasingly inaccurate representation of the current epidemic.

Comparatively, HIV sentinel surveillance could provide more accurate information of trends of HIV infection in the selected population groups and sites, particularly when conducted regularly at yearly intervals. HIV sentinel surveillance is a relatively simple and cheap epidemiological tool. Its flexibility and low cost make it feasible and sustainable even in resource poor regions. China launched HIV sentinel surveillance system in 1995 (*Xinhua News Agency, 2003*). In 1999, in response to these expanded needs for data collection, WHO and UNAIDS in collaboration with other international partners were promoting the improvement of surveillance systems based on the “second-generation” approach. This approach integrated biological surveillance — i.e. HIV sentinel surveillance, reporting of AIDS cases, and surveillance of sexually transmitted infections (STIs) — and behavioural surveillance, it is comprised the core component of current surveillance systems

(UNAIDS/WHO, 2000). The core of second-generation systems is to strengthen and improve the existing surveillance systems. Surveillance efforts are targeted at the population groups in which most new infections occur, which might change depending on the stage and level of the epidemic. Second-generation systems enable HIV sero-surveillance and behavioural data to be used and compared concurrently, allowing national programme managers not only to better understand and explain the observed trends in the HIV epidemic but also to better assess the impact of national AIDS control programmes.

WHO and UNAIDS published „practical guidelines: initiating second generation HIV surveillance systems“ in 2002 (UNAIDS, 2002-d). The guidelines particularly emphasized that the first step is to implement second generation surveillance systems based on the existing surveillance systems. These include assessment, consensus, plan and protocol development, implementation, and monitoring and evaluation. Second generation surveillance systems monitor risk behaviours, using them to warn of or explain changes in levels of infection. Therefore, second generation surveillance uses data from behavioural surveillance to explain the HIV sero-prevalence data.

The guidelines also emphasized the importance of effective coordination between surveillance and prevention programmes, since second generation surveillance is designed to provide essential data for the development of intervention and prevention strategy. They also recommend a range of surveillance strategies according to different types of HIV epidemic. In generalised epidemics, surveillance should concentrate on monitoring HIV infection and high-risk behaviour in the general population, such as antenatal pregnant women, and also include in-risk groups such as sex workers. In concentrated epidemics, surveillance should focus on monitoring infection and behaviour in higher risk groups, paying particular attention to behavioral links between members of those groups and the general population, so called bridge population such as sex worker clients, drug users who engage in unprotected sex. In low-level epidemics, surveillance should focus largely on

behaviours and HIV infection in groups at high risk, looking for changes in behaviour that may lead to an increase in the rate of infection.

China set national sentinel surveillance system in place since 1995, as a part of the campaign to fight against HIV/AIDS epidemic, the system has recorded large geographical differences in the distribution of infections in China, with some provinces recording very high prevalence rates in at-risk populations, while others report virtually no infections (*China CDC/CDC, 2002*). Surveillance systems are an integral part of an overall national framework in dealing with HIV/AIDS. HIV/AIDS surveillance systems collect important data of HIV prevalence and risk behaviors related to HIV infection, which are used to evaluate HIV/AIDS epidemic. Data help government and health partners to plan prevention and intervention strategies and target various approaches. Data collected are used not only at the national level in planning policy, but also at the local level as well. The better the quality of data, the better the ability of authorities and health partners to identify and target behavioral changes. Traditional surveillance systems tracked HIV infection or other biological markers of risk such as STIs. Since HIV infection among adults is closely related to a limited number of behaviors, such as unprotected sex with an infected partner or injection with contaminated needles, we know that if these behaviours change, there will be a change in the spread of HIV.

Since 1999, China began conducting behavioral surveillance (second generation surveillance) that targeted high-risk groups, vulnerable groups and the general public (*NCAIDS, 2001*). This was followed by epidemiological surveys among the high-risk groups. China now has in place a surveillance network that covers all 31 provinces, autonomous regions and municipalities. Much more information than in the past is now available on epidemiological trend and risk behaviour.

In 2004, 42 national-level HIV surveillance sites among 6 population groups have been established in 19 provinces, on-site survey was accomplished from September through November 2004, surveillance data were reported through national net-based directly reporting system. China CDC and provincial CDC organize national and provincial sentinel surveillance respectively. Up to the end of 2005, there were totally 105 comprehensive (second generation surveillance) national sentinel sites focusing on drug user, FSW, STD clinic clients, MSM, male long distance truck drivers and students (*China CDC, 2005*).

Since 2006, HIV/AIDS net direct reporting system was initiated in China, all identified HIV infections and AIDS cases are reported directly to China CDC through a net-based online system, an electrical form including demographic information such as gender, age, nation, resident place, and HIV/AIDS related co-infection and symptoms/syndrome was used (*China CDC, 2006*).

Although HIV and AIDS case reporting has many limitations, it should be continued, because:

- ◆ it is a good advocate instrument;
- ◆ for emerging epidemics, it could provide an early warning;
- ◆ it also helps to monitor trends and draw estimates and projections in some extent;
- ◆ it helps to calculate the burden of AIDS on the health care system.

According to the different HIV/AIDS surveillance activities that are implemented in China, HIV/AIDS surveillance could be divided into three phases:

- Passive surveillance (1985-1994) : HIV/AIDS cases were reported through the National AIDS Case Reporting System as well as the National Case Reporting System for Infectious Diseases.
- Active surveillance (1995-1998): HIV sero-prevalence surveillance, 100 national sentinel sites were established nationwide to monitor the DU population, STD patients, FSWs, and long-distance truck drivers.

- Second generation surveillance (1999-Now): Second generation surveillance systems include HIV and STI surveillance and monitor risk behaviours, using them to explain the correlation between HIV infection and risk behaviours. Target Groups for second generation surveillance include (*China CDC, 2005*):
  - High Risk Groups – Underground CSWs, DUs, MSM, and STDs Clinics Attendees
  - Vulnerable Groups – LD Truck Drivers
  - General Groups – College students

## **1.5 Drug Users in China**

Drug use continues to have a major impact on the global HIV/AIDS pandemic, both through injecting drug use, and through unsafe sexual contact. HIV is transmitted very efficiently through blood transfer, thus, needle sharing among injecting drug users (IDUs) is extremely risky. HIV can be easily transmitted by sharing infected injecting equipment, so IDUs are a group who are disproportionately affected. It is not only IDUs however, at risk of exposure to HIV; non-IDUs are also susceptible through unprotected sexual contact (*UNAIDS; 2000*).

There are many different type of drugs that used in the world and the popularity of each varies around of the world. It is estimated that in 2004, 4% of the worldwide population used cannabis, 1% used amphetamine type stimulants, cocaine, or opiates (*Heimer/Kaplan, 1992*). It is estimated that one tenth of HIV infections are a result of needle sharing and it is estimated that there are 13.2 million IDUs worldwide (*Aceijas et al, 2004*), with around 80% living in developing countries (*Riley et al, 2005*). In a number of countries, HIV infection through needle sharing is the dominant transmission route. In Russia for example 80% of HIV positive people were infected by needle-sharing (*Coalition ARVS4IDU, 2004*). Besides HIV virus, sharing needles among IDUs is also a very efficient and direct way of spreading other blood-borne viruses such as hepatitis B and C. Injecting drug users have been accounted as the groups that most affected by HIV/AIDS since the epidemic began.

Around 10% of HIV infections globally are directly a result of transmission through injection; this was about 4 million at the end of 2005 (*Riley et al, 2005*). The worst affected areas for infection through contaminated needles are Eastern Europe, Central Asia, most of Southern Asia, North Africa (*Coalition ARVS4IDU, 2004*). Around 25% of all injecting drug users live in South and South-east Asia, and a further 18% in East Asia. Each of China and India is home to more than a million IDUs. The world's highest rates of HIV infection among IDUs are found in Asia. By

1999, IDU comprised about 77% of HIV infections in Malaysia and 69% in China, and 66% of AIDS cases in Viet Nam (*UNAIDS, 2000; Coalition ARVS4IDU, 2004*).

HIV transmission in China has been mainly due to misuse of injectable drugs and unprotected sexual contact. Moreover the current epidemic of STD in China is fuelling the AIDS epidemic. IDU is the major mode of HIV transmission in China. Historically, the term 'drug abuse' referred to the smoking of opium in China. Heroin abuse first emerged as a problem in China's southern border province Yunnan in the late 1980s, which is adjacent to the opium-growing "Golden Triangle" regions of Myanmar, Thailand, and Laos (*Zhang & Ma, 2002; UNAIDS, 2000*).

Now, the practise from non-injecting to injecting drug-use is increasingly common, because injecting drug is a more cost- effective way to experience the effects of the drug (*UNAIDS, 2000*). Incomplete statistics showed the number of registered users to be 148,000 in 1991, 250,000 in 1992. The National Narcotics Control Commission reports in June 1994 that China has 250,000 registered drug users; 1,361 persons were exposed to the AIDS virus, among them over 80 percent were drug addicts. In 2003, the number of registered drug users was 1.05 million of which 643,000 used heroin; in which 74 percent of drug users were under the age of 35 and 80 percent of detained female drug users were also engaged in commercial sex (*Luo, 2004*). By the end of 2004, there were totally 1.14 million registered drug users in China (*NNCC, 2002, 2005; Liu et al, 2006-a; Chu & Levy, 2005*) (See Figure 1.3).

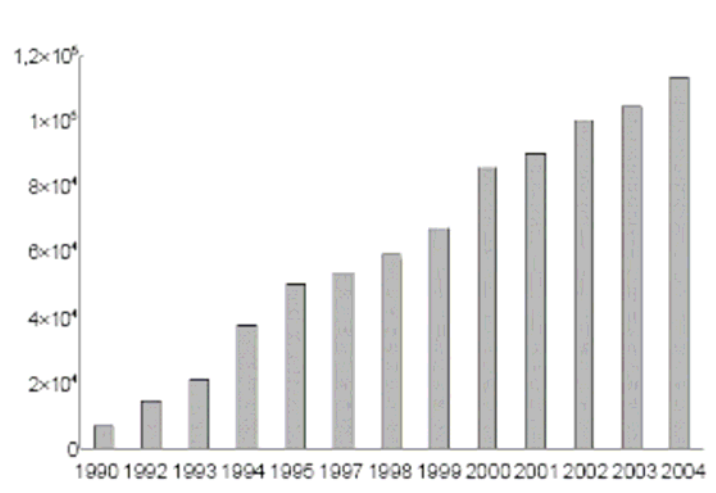


Figure 1.3 Registered drug users in China (1990-2004)

Source: NNCC, Liu *et al*, 2006-a; Chu & Levy, 2005

Widespread IDU was an early source of HIV infection in China especially in the southern provinces that border the opium-growing “Golden Triangle” regions. The geographic environment and the large market for drugs make it very difficult to eliminate and control drug use effectively.

An explosive HIV epidemic among IDUs in southwest China was mainly due to rapid increase in heroin injecting in this population. The proportion of injecting drug among all drug users is relative higher in China, a study in central China found 45%-92% of all drug users in 4 cities once injected drug (Cheng *et al*, 2003). The rapid increase in heroin injecting in this population appears to have triggered an explosive HIV epidemic among IDUs in southwest China (Xiao *et al*, 2007).

Risk behaviours among IDUs are mainly due to needle-sharing, and unprotected sex among drug users and their partners (Zheng *et al*, 1994). And with respect to the rapid spread of HIV among drug users, the really risky behaviour is needle sharing. Most drug users in China tend to be young, less educated, unmarried, and without a stable occupation; these factors lead this population group to engage most likely in risk behaviours, such as injecting drug and unprotected sex. Although typically male, the proportion of female drug abusers has increased rapidly in the last decade (Tucker *et al*, 2005; Qian *et al*, 2005). Concurrently, drug abuse also has moved



from being concentrated almost exclusively in the low-income and less educated level of Chinese society to all of its social levels.

MOH reported that by the end of 1989, HIV/AIDS has been reported in 10 provinces and regions, the number of HIV cases in China has risen to 194, of which three foreigners had developed AIDS. The sharp increase was due to HIV testing among drug users in Yunnan province. These tests revealed 146 cases of HIV infection in Yunnan (*Zheng et al, 1994*). This was the first time China has traced HIV/AIDS cases among drug users in remote areas. From 1985 to 1990, a total of 446 cases have been confirmed HIV positive and five (two Chinese citizens and three from outside China) have progressed to AIDS. Of the 446 cases, 378 were Chinese citizens and 68 were from outside China. Of the 378 Chinese citizens, 368 were from Yunnan and all were related to the sharing of needles (*MOH, 1995*).

The sharing of needles is a highly effective mode of HIV transmission, and HIV prevalence among IDUs was found to range between 44% and 85% in selected communities of drug users in Yunnan and Xinjiang provinces. In 1995, survey results found no HIV infection among drug users in 8 sentinel surveillance sites. In February 1996, MOH reported China's drug user population was increasing rapidly. In 1998 however, HIV infection had been found in 17 of 19 sentinel surveillance sites. HIV infection prevalence rates among drug users in Urumqi had increased from 0% in 1995 to 28.8% in 1998; in Guangxi and Guangdong, from 1% in 1997 to 12.8% and 10.4% respectively, and 17% in Jiangxi in 2000. The highest HIV prevalence rate was 82.2% among drug users in Yining city (*MOH et al, 2000-a*).

Up to June 1998, two thirds of reported HIV infection cases lived in rural China, and nearly one third of the 301 people diagnosed as having AIDS have died. About 10% of all HIV infections occurred among teenagers under age 19 years old, with most infected through intravenous drug use (*Zha, 1998*). There have been reports of an increase in the sharing of equipment by drug users, increasing from 32% in 1999, to 34% in 2000, and to 45% in 2001 (*MOH, 2001-b*). Nine provinces are now on the edge of IDU-related HIV epidemics due to very high rates of needle sharing.

Increasing rate of HIV infections among commercial sex workers in several provinces, many of whom inject drugs, is forming a bridge to the general population, speeded by low condom use and little knowledge of AIDS. Yunnan suffered first HIV epidemic in China, and accounted the biggest number of HIV infection in China. There are a number of sentinel sites that HIV prevalence among IDU is relative higher, for example, Xinjiang Yining 84%, Yunnan Ruili >80%, Sentinel sites in Guangdong 21%, Guangxi Baise over 30% (*MOH, 2000-b*) (See Table 1.4).

Table 1.4 Provinces and sites with highest HIV infections rates among IDU (2000)

<i>Provinces</i>	<i>Sites/Rates</i>			
Xinjiang	Yining 84%		Urumqi 39%	
Yunnan	Ruili > 80%	Wenshan 75%	Kaiyuan 58%	Yingjiang 70%
Guangdong	Sentinel Site: 21%			
Guangxi	Baise 30%~40%	Pingxiang 12%	Liuzhou 12%	
Jiangxi	Sentinel Site: 17%			

*Source: MOH, China CDC*

By the end of 2003, it was estimated totally 840,000 people were living with HIV/AIDS, IDU accounted for about 70% of total reported cumulative HIV infections. The number of provinces that have reported HIV infections among IDUs increased from one province in 1994 to 21 provinces in 1999 (*China CDC, 2003*). Outbreaks of HIV infections have been reported among IDUs in Yunnan, Xinjiang, Guangxi, Sichuan, and Guangdong provinces and autonomous regions. HIV infection rate among IDUs has reached 20%--30% in some areas in these provinces, and about 60%--80% in Ruili, Yunnan Province and Yining, Xinjiang Autonomous Region. Large numbers of drug users continue to share equipment (73% in Hunan, 81% in Jiangxi and 100% in Xinjiang) (*China CDC, 2004/MAP, 2005*). By the end of 2005, there were approximately 650,000 people living with HIV/AIDS in China; in which 288,000 were drug users living with HIV/AIDS, accounting for 44.3% of the total number of estimated HIV cases (*MOH, 2006*).

## 1.6 HIV/AIDS Epidemic in Yunnan

Yunnan is one of the areas of China with alarmingly high rates of drug use. Yunnan province experienced the first HIV/AIDS epidemic in China, among mainly injecting drug users in rural communities close to the borders with Myanmar, Lao PDR and Viet Nam. The south-eastern region of Yunnan is a key site for drug trafficking and HIV-1 infection spread from the west of Yunnan to other regions of inner province and outer province. HIV/AIDS is spreading rapidly across the province and from minority national groups into the Han majority population (*Xiao et al, 2007*).

Yunnan also has one of the highest prevalence rates of HIV/AIDS infection. Intravenous drug use and sharing of needles are the primary causes of HIV/AIDS transmission in the region. It is estimated that 70% of the HIV infections in Yunnan are due to injecting drug use (*Pan et al, 1997*). Drug use negatively impacts not only to the users themselves, but also their families, their communities and society. The continued high prevalence of drug use also causes additional health problems, not only the acceleration of the spread of HIV/AIDS, but also increase the financial burden on limited health resources.

From 1985 to 1990, a total of 446 cases have been confirmed HIV positive and five (two Chinese citizens and three from outside China) have progressed to AIDS. Of the 446 cases, 378 were Chinese citizens and 68 were from outside China. Of the 378 Chinese citizens, 368 were from Yunnan and all were related to the sharing of needles (*MOH, 1995*). In 1993, China opened its first AIDS hospital in Ruili City, Yunnan. The Chinese government decided to place the hospital in Yunnan province because Yunnan has had the largest number of HIV cases in China, and Ruili City had the largest number of HIV cases in Yunnan at that time. Up to 1993, China has had 1,106 confirmed HIV cases, 850 of whom were located in Yunnan, and Ruili City has had 425 confirmed HIV carriers. Yunnan province has had four confirmed AIDS patients, three of which have already died (*MOH, 1995*).

Up to 1994, MOH reported that 1,453 have tested positive for HIV since the first case was detected in 1985. 22 of China's 31 provinces, autonomous regions and municipalities have reported cases of HIV infection. Of all China's registered HIV infections 1,174 were Chinese, of which 70 percent were infected through intravenous drug use (*MOH, 1995*). However, only high-risk groups were being tested.

In Yunnan, HIV has spread beyond the initial IDU epidemic in Dehong Prefecture to resident populations throughout much of the Province. People living with HIV/AIDS were found in all 16 prefectures and in 111 counties by the end of 1999 (*MOH, 2001-a*). HIV infection rates were very high in resident IDU populations of an increasing number of cities in Yunnan, above 50% and even as high as 80%. A total of 5,678 HIV infections have been reported from 1987 through September 1998 accounting for 51% of the total reported HIV infections in China. Remarkable changes have started to occur over the last couple of years with respect to the descriptive epidemiological characteristics of HIV transmission in Yunnan. Indeed, while the predominant route of transmission remains sharing of needles among injecting drug users, the overall rate of IDU among total HIV has decreased from 87% in 1997 to 75% in 1998. Surveillance data in 2000 reported HIV prevalence rates among IDU up to 69.4%, with an average rate of 26.5%. The prefectures with HIV infection rates above 40% were Dehong, Wenshan, Lincang, Honghe, Dali and Kunming (*MOH, 2001*).

Sexual transmission has started to increase since mid-1997 and the overall percentage of HIV infection transmitted by sexual contact in 1998 reached nearly 14%. Provincial sentinel surveillance among STD patients has produced evidence in 1998 that sexual HIV epidemics have started in a number of sites including Ruili, Dali and Lijiang in Yunnan province (*MOH, 1998*). There were 4 recorded cases of mother-to-child HIV transmission. The highest prevalence of HIV/AIDS (78%) was in young people between 15 and 30 years. More women were becoming infected as

evidenced by a shift of the male to female ratio from 4:1 in 1997 to 3:1 in 1998 (*SFPC, 2002*). The last couple of years also saw the shift of HIV infection from mainly among national minorities to an equal distribution among minority populations and the majority Han population.

Up to 1997, Yunnan has had 4,421 HIV/AIDS cases, of which 91 percent contracted AIDS through intravenous drug use. Of the HIV cases, 98 have developed AIDS and 84 have died. Some 70 percent of counties in Yunnan have reported HIV/AIDS cases. Up to 1998, Yunnan has tested more than 457,000 for HIV/AIDS (*MOH, 1998*).

In 1999, there were significant increases in HIV infection among male STI patients in Baoshan, and among sex clients in Kunming City. In 2000, the HIV prevalence among male STI patients reached up to 8% with an average of 2.7%. HIV infections among male STI patients rapidly increased in Binchuan, Gengma, Chuxiong and Kunming. Among female STI patients the rates reached up to 13% with an average of 1.9% (*MOH, 2001-a*). HIV infections are also shifting from rural to urban areas and from border communities to interior populations. In 1989, Yunnan officials reported 149 HIV carriers. In 1999, the number of HIV carriers accounted for 43.6 percent of the national total. In September of 2001, Yunnan had 70,000 estimated cases of HIV infections, with 11,957 registered cases of HIV, which represented 32 percent of the national total (*MOH, 2001-b*); in September of 2003, 13,948 HIV positives and 841 AIDS patients had been reported in Yunnan (*Xinhua Agency, 2004*). In 2004, the HIV-1 prevalence among IDUs in Yunnan was between 21.2%-27.8%. By the end of 2004, Yunnan had cumulatively reported 28,391 HIV infections (*MOH, China/WHO; 2004*).

Zhang et al. studied HIV-1 patients in Yunnan using immunoassays found HIV-1 subtype C/CRF07\_BC/CRF08\_BC and CRF01\_AE were codominant among IDUs, the discovery of many sexually transmitted CRF01\_AE cases was new and suggested that HIV-1 could be transmitted through “bridge population” into general population, this subtype may lead to a new epidemic in the general Chinese population (Zhang et al., 2006). The same phenomena also found in another HIV-1 molecular epidemiological study by Zhang et al. in 2004 in Xinjiang found HIV-1 infected by homo- or heterosexual transmission multiple subtypes of HIV-1 which were related to strains dominated among IDU suggested HIV-1 has spread into general population (Zhang et al., 2004). Yu et al. found unprotected sex continued to occur at high rates among IDU and their sex partners in Yunnan (Yu et al., 2003).

Some studies have found drug users were more likely to engage in high-risk sexual behaviors, and most female drug users engaged in commercial sex (Zhang et al., 2002; Yang et al., 2005; Qian et al., 2005; Tucker et al., 2005; Chu & Levy, 2005). A number of studies suggest that HIV infection spread from high risk groups into the general population mainly due to sexual transmission (Zhang et al., 1999; Zhang et al., 2001; Huang et al., 2004; MOH, China/WHO, 2004; Hesketh et al., 2005; Zhu et al., 2005, Shao, 2006; Lonn et al, 2007). A study by Liu et al found HIV-1 prevalence among IDUs in rural Guangxi was 25% (172/702) (Liu et al., 2006-b), a study in Xinjiang showed HIV prevalence among drug users was 24.5%, and among IDUs was significantly higher (56.1%) (Ni et al, 2006).

Unfortunately, the HIV epidemic continues to spread among and from IDUs in China. By the end of 2005, there were approximately 650,000 people currently living with HIV/AIDS in China, in which there were approximately 288,000 drug users living with HIV/AIDS, accounting for 44.3% of the total number of estimated HIV cases. Seven provinces – Yunnan, Xinjiang, Guangxi, Guangdong, Guizhou, Sichuan, and Hunan – each have more than 10,000 drug users infected with HIV, and these 7 provinces account for 89.5% of the HIV/AIDS cases among drug users

(*WHO, UNAIDS; 2006*). Today, Yunnan still has the most HIV-1 infected number than any other provinces in China, accounting for one-fourth of the reported cases.

Chinese government has made efforts to improve HIV/AIDS surveillance systems since the emergence of HIV epidemic, policy and strategy focus on HIV education, prevention, and care have been implemented through the country.

# Chapter II

## OBJECTIVES AND METHODOLOGY

*“We can not deal with AIDS by making moral judgements or refusing to face unpleasant facts - and still less by stigmatising those who are infected and making out that it is all their fault.”*

--- Kofi Annan,  
*(former Secretary General, United Nations)*



## 2.1 Objectives

HIV surveillance is the systematic collection of information on the occurrence, distribution and trends of HIV infection among specific populations on an ongoing basis. Data from HIV surveillance are used to estimate HIV prevalence in selected populations, to monitor trends of HIV epidemic in these populations, and to guide and evaluate the planning and implementation of HIV/AIDS prevention and control program activities (*UNAIDS/WHO, 2000*), as well as to provide useful information for policy maker.

Through sentinel site surveillance, it is expected to obtain the AIDS-related behavioral information and its time trends among target population in order to provide early warning of AIDS epidemic; to provide information and basis for evaluation of HIV/AIDS intervention strategies and their effectiveness and to determine the point prevalence of HIV infection by serological examination which, performed consistently over years, serves to monitor the distribution and trend of the HIV epidemic in China.

This study concentrates on 2005 HIV second generation surveillance on drug users in China, it helps to determine prevalence of HIV-1, risk behaviours and demographic characteristics associated with HIV-1 infection among drug users in China based on the national second-generation surveillance on drug users in 2005.

## **2.2 Methodology**

HIV surveillance system in China mainly includes HIV/AIDS case reporting system and HIV sentinel surveillance system, there are also a number of special studies focusing on HIV behaviours as supplement (*CDC, China/CDC; 2002*).

HIV/AIDS second generation surveillance is an annual routine work in monitoring specified groups in China (i.e. DU, FSW, STD clients, MSM, long distance truck drivers and young students), cross-sectional survey is conducted with standardized questionnaire, it helps to trace the behaviour change over time, to describe the HIV/AIDS epidemic, but every year, the sentinel sites are not always the same.

For the drug users in Chinese surveillance system, there is no specific target group for IDU, but as drug user group, it includes IDU and Non-IDU drug user).

### **Principals of implementation of surveillance**

- Sentinel sites should be established according to the epidemic level and resource availability in different regions, to implement targeted technical support and guidance;
- Multi-sectoral cooperation should be fostered in defining respective responsibility and co-operation;
- Ethical requirements and professional moral should be followed in surveillance work, to keep informed consent and confidentiality.

### **Target population groups:**

- High Risk Groups – Underground CSWs, DUs, MSM, and STDs Clinics Attendees
- Vulnerable Groups – LD Truck Drivers
- General Groups – College students

This paper only focused on drug users.

## **Definition and source of target population**

### **Drug users**

Definition: people who smoke, intravenously or intramuscularly use heroin, cocaine, opium, marijuana, morphine, methamphetamine hydrochloride, pethidine, K powder (ketamine), and dancing outreach.

Sample Source: drug users from communities and detoxification centers. Drug users from communities provide better representativeness but recruitments of participants are considerably difficult because of their hidden behaviours. Each sentinel site should try the community-based surveillance according to local situation, e.g. the snow-ball method could be used. During the defined timeframe, if in the case that the subjects could not be adequately recruited from the community to meet requirement of sample size, the recruitments could be made from drug users who have been recently admitted in the detoxification centers in supplementing the sample size. Principally, the number of drug users recruited from detoxification centers could not exceed 50% of total sample size, and the duration of the drug users at detoxification center should be less than three months.

### **Principals of selection of surveillance sites for drug users**

- National HIV surveillance sites are designed on the basis of administrative area, city (city at prefecture level) or county (city at county level) is considered the basic unit to set surveillance site. Sustainability of the sites will be the priority consideration. The number of sites collecting data each year is selected based on local HIV epidemic level and resource availability. According to the local HIV/AIDS epidemic situation and prevention and control needs at provincial level, the National Surveillance System will gradually increase or adjust the number of sentinel sites in different areas.

- According to the provincial epidemic trend, every province should set high-risk population surveillance sites for drug users. Provinces that HIV prevalence among drug users over 5% should set at least 1 surveillance site, sites in provinces that HIV prevalence among drug users below 5% or HIV positive was found could also be selected to compare the differences of demographic characteristics and risk behaviors in different sites.
- Factors such as the local economic development, number of floating population as well as available local medical resources should be considered when the sentinel sites are established.

### **Surveillance methods**

#### **Surveillance frequency and timeframe**

Annual surveillance is implemented among drug users.

Surveillance period of second generation surveillance sites in each year is from July to September. In some special cases or if there is an urgent event, the surveillance period could be appropriately adjusted after discussion with National Center for AIDS Prevention and Control.

During each surveillance period, questionnaire survey will be conducted among the surveillance subjects and the sentinel sites should try their bests to collect serum specimen from all subjects. Detection of both HIV antibody and syphilis antibody should be conducted for all subjects.

#### **Behavioral surveillance**

Quantitative surveys are carried out through questionnaire, i.e. a face-to-face interview is conducted by trained investigators with a standardized designed questionnaire in order to collect information on demographic characteristics, risk behaviours, knowledge and attitudes towards HIV/AIDS among drug users.

### **Serological detection of HIV and interpretation of results**

- Two ELISA assays will be used for testing HIV antibodies. If blood specimens is positive from the first ELISA assay, the second ELISA assay with different principle (or with different antigen, or at least from different manufacturer) will be used for re-testing. Those specimens with positive results for both ELISA assays are considered positive for HIV antibody. Antigen should be distributed by National Center for AIDS Prevention and Control, no allowance for self exchange.
- Laboratory methods for detection of HIV antibodies refer to the *National Working Guidelines for HIV Detection*, and manufacturer's instructions of testing kits.
- Laboratories to provide HIV antibody detection: the detection of HIV antibody could be done by the HIV screening laboratories officially approved by the provincial HIV confirming laboratories or by the institutions responsible for the national HIV comprehensive surveillance sites at the provincial level. Provincial HIV confirming laboratories should conduct quality control for the HIV screening laboratories regularly.
- In order to ensure the laboratory testing quality and avoid the waste of testing kits, the lab detection should be conducted after completion of all specimen collection.
- National Center for AIDS Prevention and Control conducts a non-scheduled quality control and evaluation of the provincial institution responsible for the national HIV sentinel sites in its jurisdictions and to the relevant units assigned by the provincial institution for HIV surveillance and testing.
- For all serum specimens, the leftover sera after testing for HIV antibody and STD (syphilis antibody) should be stored appropriately at -20°C for eventual check.

### **Serologic tests for syphilis and interpretation of results**

- Rapid plasma reagin test (RPR) is used to detect syphilis antibodies in serum specimens.
- Serological assays for detection of syphilis antibodies refer to Standard Operating Procedure for Laboratory Detection of STDs, and manufacturer's instructions of reagents.
- Laboratories to provide syphilis antibody testing: the tests should be conducted by the screening laboratories approved by the provincial HIV confirmed laboratories or the provincial authorities.

Reagent used in 2005 national HIV surveillance on drug users:

First HIV ELISA test: ELISA reagent: (Wantai Biotech, Beijing, China)

Second HIV ELISA test: ELISA reagent: (Vironostika HIV Uniform II Ag/Ab. Akzo Organon Teknika, Netherlands)

Syphilis RPR reagent: (Kehua Biotech, Shanghai, China; Lizhu Biotech, Zhuhai, China)

### **Sample size and sampling methods**

#### **Sample size**

$$n = D \frac{\left[ Z_{1-\alpha} \sqrt{2\bar{P}(1-\bar{P})} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right]^2}{(P_2 - P_1)^2}$$

$D$  = Design efficiency: the efficiency of complete randomized sampling is 1; in order to ensure the accuracy in estimation of sample size from multi-stage cluster sampling to be the same as that in simple randomized sampling, a coefficient of sample size has to be used, and the design efficiency is usually to be  $D = 1.5$  or  $D = 2$ ;

$P1$  = proportion of a given behavioral indicator estimated from the first round of survey;

$P2$  = proportion of a given behavioral indicator estimated from the consequent rounds of surveys, making  $(P2-P1)$  be equal to the value (difference) you expect to find;

$=(P1+P2)/2$ ;

$Z1- \alpha$  = Z value in accordance with the expected significant level;

$Z1- \beta$  = Z value in accordance with the expected confidence level;

In compliance with a standardized protocols in the sentinel sites, based on the calculation of sample size using the mathematic formula, and taking the characteristics of the surveillance populations, the sample size for each sentinel site and each round of surveillance survey requires 300-400 subjects for each target population.

### **Sample method for drug users**

#### **Drug users in the community**

Drug users are mainly from the community. However, drug users in the community have characteristics of sporadic distribution, concealment, and sensitivity, thereby leading to difficulties for mapping and randomized sampling, the convenience sampling and snowball sampling methods, therefore, could be used.

#### Convenience sampling method

Through interviewing key informants, local government department, police and community members to know about distribution of locations where drug users reside and use drugs, the drug users could be found will conduct the survey. If the drug user found by this way rejects to be investigated, next drug user could be recruited and so on until the expected sample size is reached.

#### Snowball method

Investigator should find a key informant or a drug user recognized by surveillance department and this informant or drug user gives the names, address, and other

contact information of second drug user (or second group of drug users) for investigation, who provides the names, address, and other contact information of third drug user (or third group of drug users) in the same way, and so on to increase samples through snowballing process until the expected number of sample size is reached.

It is apt to result in selection bias if snowball method is used because informants tend to provide their familiar or close drug users and some of these drug users can influence each other in behavioral practice, resulting in similar behaviors (e.g. syringe and condom use) among them. Therefore, it is better to objective select target population with several different behaviors for initial surveys in order to avoid or reduce selection bias.

If there are many drug users in the local community and it is more likely to access these drug users through interviewing local government department, police and community members to know about the distribution of the locations where drug users engage drug-use practice; therefore, sampling frame and mapping can be developed.

### **Drug users in detoxification center**

If enough number of subjects could not be obtained in community, the inadequate part could be recruited from detoxification center to supplement the sample size. In principal, the number of drug users recruited from detoxification center could not exceed 50% of expected sample size and the duration of the recruited drug users to admit to the center should be less than three months. In detoxification center, randomized sampling should be used – i.e. listing all drug users in the center and coding them for randomized sampling.

### **Survey procedure**

National standardized questionnaire for drug users is used in sentinel sites by interview, the questionnaire consists of information of demographic characteristics, HIV related behaviours and knowledge, and test results of HIV and syphilis. Local



CDC investigators who are trained according to the surveillance protocol conduct the interview, in addition, verbal informed consent should be obtained before the investigation to emphasize the anonymity and confidentiality of the survey.

### **Data cleaning and analyse**

there were totally 6539 samples in 21 surveillance sites which conducted survey included HIV and STI surveillance and risk behaviours, one site in Kunming, Yunnan province was excluded due to lack of key information about risk behaviour. At first, data cleaning was conducted, 649 samples were dropped according to one of the following reasons; i.e. no blood taking, no HIV and syphilis test results, logic errors that could not be revised even after the consultation with local CDC charge person, in which in 621 cases no blood test was performed (blood samples were either insufficient for conducting HIV test, blood taking was not successful or the patients rejected). In one case first HIV test was negative and the second positive, but second test should be performed only if the first test was positive. In 26 cases age of the first drug use was below 10 and additionally in one case the age was reported as 13 years. All other participants reported first age use starting from 14 to 60, we therefore decided to consider the 27 cases as coding errors. Other missing values and logic errors were revised under the suggestion of local CDC charge person.

After data cleaning, a total of 5890 records were included in the analysis. SPSS software (version 14.0 for Windows; SPSS Inc., Chicago, IL) was used to analyse the dataset,  $\chi^2$  statistics with *P*-values were used to compare HIV-1 and syphilis prevalence associated with demographics, drug use and sexual risk behaviours. Logistic regression was used to analyse independent association between HIV-1 status and risk behaviours, syphilis status and risk behaviours.

# **Chapter III**

## **RESULTS**

*“It is a big challenge to understand HIV/AIDS from the limited data available.”*

*--- Mary A. Foulkes  
(NIH)*

### **3.1 Sample Characteristics**

#### **3.1.1 General information**

There were totally 6539 samples in 21 surveillance sites which conducted survey included HIV and STI surveillance and risk behaviours, one site in Kunming, Yunnan province was excluded for lack of key information about risk behaviour – first generation surveillance was conducted there. However, the HIV-1 sero-prevalence in Kunming, Yunnan was significantly higher than other sites, 54% (54/100).

After data cleaning, 649 samples were deleted for any one reason of which not taking blood, and no HIV and syphilis test results, logic errors that could not be revised even after the consultation with local CDC charge person. Other missing values and logic errors were revised under the suggestion of local CDC charge person. Some variables were re-categorized or merged for further bi-variable and logistic regression analyse or there was too few cases in such category.

#### **Demographic and socio-economic information**

There were totally 21 surveillance sites , sample size was 5890. 21 surveillance sites were selected from 13 provinces, there was geographical and socio-economical difference between province, provinces from higher GDP east coast and provinces from lower GDP west and south-west were selected, they were Anhui (Huainan, Maanshan), Gansu (Dingxi, Wuwei), Guangxi (Nanning), Guangdong (dongguan), Guizhou (Qianxinan, Tongren), Hebei (shijiazhuang), Hubei (jingzhou, Xiaogan), Liaoning (Fushun), Qinghai (Haidong, Haixi), Sichuan (Dazhou, Leshan, Liangshan), Xinjiang (Yili, Kashi), Zhejiang (Hangzhou), and Chongqing. Among the 21 survey sites, there were 14 sites with more than 200 records available (Sichuan Dazhou, Zhejiang Hangzhou, Guangxi Nanning, Xinjiang Kashi, Hubei Xiaogan, Gansu Wuwei, Hebei Shijiazhuang, Guizhou Qianxinan, Chongqing, Guizhou Tongren, Guangdong Dongguan, Hubei Jingzhou, Sichuan Liangshan, and Qinghai Haixi), for 5 other sites there were 100-200 records (Anhui Huainan, Anhui Maanshan, Qinghai Haidong, Sichuan Leshan, and Gansu Dingxi) and for two sites (Liaoning Fushun and Xinjiang Yili) were less than 100 records. 10 sentinel sites reached the needed sample

size (300-400), they were Gansu Wuwei, Guangdong Dongguan, Guizhou Qianxinan, Guizhou Tongren, Hebei Shijiazhuang, Hubei Xiaogan, Hubei Jingzhou, Qinghai Haixi, Sichuan Liangshan, and Chongqing. The rest sentinel sites did not recruit the needed samples.

See the following figure about HIV reported cases in every single province. See Figure 3.1.

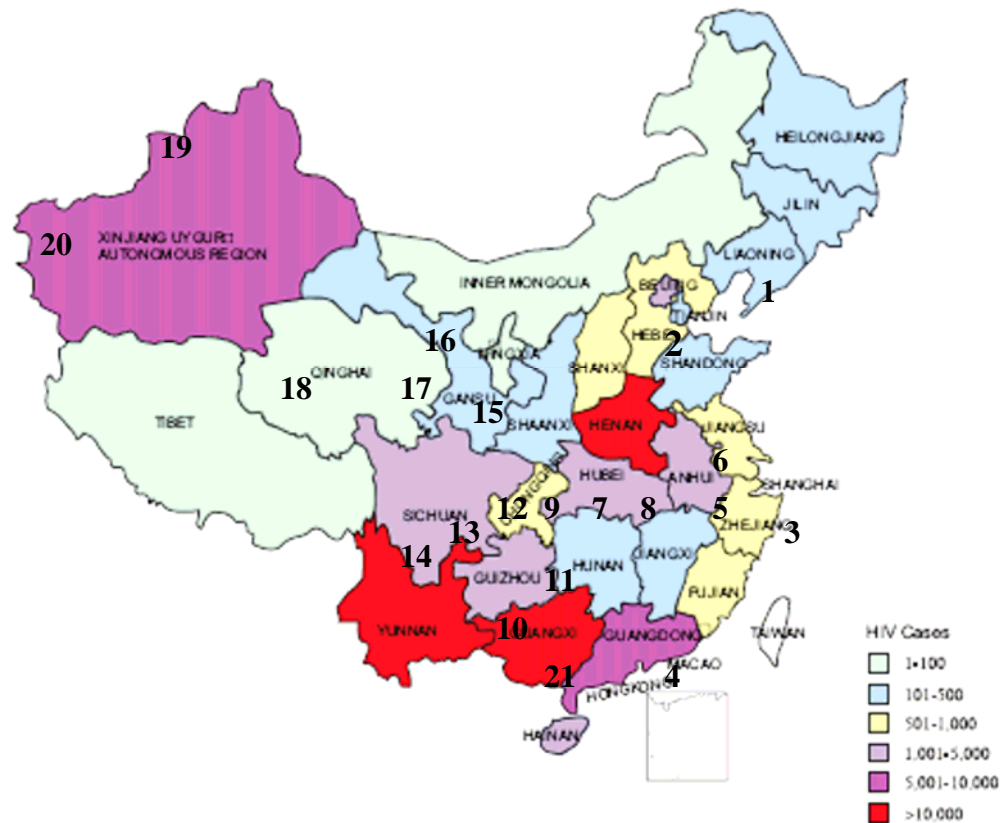


Figure 3.1 The geographic distribution of cumulative reported HIV-1 cases in China 1985- 2004 and sentinel sites among drug users in 2005\*

source: WHO: *A Joint Assessment of HIV/AIDS Prevention, Treatment and Care in China* (2004)

\*sentinel sites (HIV-1 prevalence): 1 Liaoning Fushun (0%), 2 Hebei Shijiazhuang (0%), 3 Zhejiang Hangzhou (0%), 4 Guangdong Dongguan (5.9%), 5 Anhui Huainan (0%), 6 Anhui Maanshan (0.7%), 7 Hubei Xiaogan (0.9%), 8 Hubei Jingzhou (0.5%), 9 Chongqing (7.3%), 10 Guizhou Qianxinan (0.4%), 11 Guizhou Tongren (4.5%), 12 Sichuan Dazhou (0.4%), 13 Sichuan Leshan (2.6%), 14 Sichuan Liangshan (29.4%), 15 Gansu Dingxi (0%), 16 Gansu Wuwei (0%), 17 Qinghai Haidong (0.6%), 18 Qinghai Haixi (0%), 19 Xinjiang Yili (0%), 20 Xinjiang Kashi (10.8%), 21 Guangxi nanning (21.0%)

### **Sample source**

55.8% from detoxification centre, 30.9% from community, others 12.7%.

### **Gender**

Male accounted a major part, 84.4%. male female ratio was 5.6:1.

### **Age**

Age rank was between 14-78, median was 30.0, mean was 31.6, in which 51.9% were equal or younger than 30, 48.0% were elder than 30.

### **Marital status**

Married was 6.1%, single 40.7%, cohabited 38.7%, divorced or widowed 13.5%. In order for further bi-variable and logistic regression analyse, the variable was re-categorized into two groups: live alone (includes single, divorced and widowed) 54.2%, and live with partner (includes married and cohabited) 44.8%.

### **Resident place**

84.4% drug users were local residents (have local permanent resident permission), 14.9% were transient (have temporary local resident permission).

### **Nation**

Most were Han Chinese, were 72.9%, 25.9% were minorities. There were totally 55 minorities in China, there was no detailed information about single minorities in this study, thus, minority was used to refer non-Han.

### **Education**

Education refers the highest diploma that subject received inland and overseas, or similar with his/her current knowledge.

- Illiteracy (never in school): character is can not read newspaper, can not write informal note.
- Primary school: the highest education is primary school graduate, drop-out, and in-school; and any one has similar diploma. It also includes who never

was in primary school but can read newspaper and write informal note. (in general 6 years education).

- Middle school: the highest education is middle school graduate, drop-out, and in-school; and any one has similar diploma. (in general 9 years education).
- High school or professional high school: the highest education is high school graduate, drop-out, and in-school; and any one has similar diploma. (in general 12 years education).
- College or above: the highest education is college or above graduate, drop-out, and in-school; and any one has similar diploma. (in general over 15 years education).

In china, the compulsory education is 9 years to graduate from middle school.

In this study, the most were middle school 48.4%, primary school 23.7%, high school or above 17.0%, illiterate 8.7%. In order for further bi-variable and logistic regression analyse, the variable was re-categorized into two groups: education equal or less than 9 years (includes illiteracy, primary school and middle school) accounted for 32.4%, and education more than 9 years (includes high school and college or above) accounted for 65.4%.

### **Profession**

There were 15 profession categories, 1 student, 2 teacher, 3 home maid, 4 service industry personnel, 5 shop assistant, 6 medical staff, 7 worker, 8 migrant worker, 9 peasant, 10 farmer, 11 fisher, 12 officer, 13 pensioner, 14 home worker, 15 other. In for further bi-variable and logistic regression analyse, the variable were re-categorized into two groups: white collar (includes student, teacher, medical staff, officer and pensioner) 32.7%, and blue collar (other rest categories) 64.1%.

### **Monthly income**

40.7% samples monthly income equal or less than 600 RMB, 20.9% earned 601-2000 RMB per month, 5.8% earned more than 2000 RMB. The missing values were 32.5%.

### 3.1.2 HIV-1 and syphilis infection

#### HIV-1 infection

HIV-1 positives were 297, HIV-1 positive rate was 5.0%. 13 sentinel sites found HIV-1 positive, 5 sentinel sites HIV-1 positive rate were over 5%, in which Guangdong Dongguan (5.9%), Chongqing (7.3%), Guangxi nanning (21.0%), Sichuan Liangshan (29.4%), and Xinjiang Kashi (10.8%), respectively. Detailed information see table below (Table 3.1).

Table 3.1 HIV-1 prevalence in surveillance sites

Sites	Number of HIV <sup>+</sup>	Total	HIV prevalence % (95% CI)
Anhui Huainan	0	113	0.0 (0.0-3.2)
Anhui Maanshan	1	141	0.7 (0.1-3.9)
Gansu Dingxi	0	193	0.0 (0.0-2.0)
Gansu Wuwei	0	357	0.0 (0.0-1.1)
Guangxi Nanning	61	291	21.0 (16.7-26.0)
Guangdong Dongguan	24	407	5.9 (4.0-8.6)
Guizhou Qianxinan	1	363	0.3 (0.1-1.6)
Guizhou Tongren	17	376	4.5 (2.8-7.1)
Hebei Shijiazhuang	0	361	0.0 (0.0-1.1)
Hubei Jingzhou	2	409	0.5 (0.1-1.8)
Hubei Xiaogan	3	352	0.9 (0.3-2.5)
Liaoning Fushun	0	28	0.0 (0.0-12.1)
Qinghai Haidong	1	163	0.6 (0.1-3.4)
Qinghai Haixi	0	478	0.0 (0.0-0.8)
Sichuan Dazhou	1	223	0.4 (0.1-2.5)
Sichuan Leshan	5	189	2.6 (1.1-6.1)
Sichuan Liangshan	122	415	29.4 (25.2-34.0)
Xinjiang Yili	0	99	0.0 (0.0-3.7)
Xinjiang Kashi	32	297	10.8 (7.7-14.8)
Zhejiang Hangzhou	0	267	0.0 (0.0-1.4)
Chongqing	27	368	7.3 (5.1-10.5)
Total	297	5890	5.0 (4.5-5.6)

### Syphilis infection

There were 162 syphilis positive, positive rate is 2.8%, 11 sites found syphilis positive. Guangxi Nanning (17.5%), Guangdong Dongguan (9.6%), and Xinjiang Kashi (10.4%) were the three highest sites, all over 5%. See Table 3.2

Table 3.2 HIV prevalence in surveillance sites

<i>Sites</i>	<i>Number of syphilis<sup>+</sup></i>	<i>Total</i>	<i>syphilis prevalence % (95% CI)</i>
Anhui Huainan	3	113	2.7 (0.9-7.5)
Anhui Maanshan	5	141	3.6 (1.5-8.0)
Gansu Dingxi	5	193	2.6 (1.1-5.9)
Gansu Wuwei	0	357	0.0 (0.0-1.1)
Guangxi Nanning	51	291	17.5 (13.6-22.3)
Guangdong Dongguan	39	407	9.6 (7.1-12.8)
Guizhou Qianxinan	1	363	0.3 (0.1-1.6)
Guizhou Tongren	0	376	0.0 (0.0-1.0)
Hebei Shijiazhuang	0	361	0.0 (0.0-1.1)
Hubei Jingzhou	0	409	0.0 (0.0-0.9)
Hubei Xiaogan	0	352	0.0 (0.0-1.1)
Liaoning Fushun	0	28	0.0 (0.0-12.1)
Qinghai Haidong	0	163	0.0 (0.0-2.3)
Qinghai Haixi	4	478	0.8 (0.3-2.1)
Sichuan Dazhou	5	223	2.2 (1.0-5.1)
Sichuan Leshan	3	189	1.6 (0.5-4.6)
Sichuan Liangshan	15	415	3.6 (2.2-5.9)
Xinjiang Yili	0	99	0.0 (0.0-3.7)
Xinjiang Kashi	31	297	10.4 (7.5-14.4)
Zhejiang Hangzhou	0	267	0.0 (0.0-1.4)
Chongqing	0	368	0.0 (0.0-1.0)
Total	162	5890	2.8 (2.4-3.2)



All 21 drug use sites were categorized into three groups according to geographical and economical difference. See table 3.3.

Geographic region:

1. East coast: Liaoning (Fushan), Hebei (shijiazhaung), Zhejiang (Hangzhou), Guangdong (Dongguan)
2. Central region: Anhui (Huainan, Maanshan), Hubei (Xiaogan, Jingzhou), Chongqing
3. West and South-West: Guangxi (Nanning), Guizhou (Tongren, Qianxinan), Sichuan (Dazhou, Leshan, Liangshan), Gansu (Dingxi, Wuwei), Qinghai (Haidong, Haixi), Xingjiang (Kashi, Yili)

Table 3.3 Regional GDP per capita 2004

<i>Region</i>	<i>Provinces</i>	<i>HIV prevalence</i>	<i>GDP per capita (RMB)</i>
East	Liaoning, Hebei, Zhejiang, Guangdong	2.1%	18,216
Central	Anhui, Hubei, Chongqing	2.4%	9,292
West and South-West	Guangxi, Guizhou, Sichuan, Gansu, Qinghai, Xingjiang	6.1%	7,550

Source: national statistical annual report 2005. National Bureau of Statistics, China.

<http://www.stats.gov.cn/tjsj/ndsj/2005/indexch.htm>

Then, every single region was categorized into two groups according to the HIV-1 prevalence tested in target populations, low HIV-1 sub-region when HIV-1 prevalence below 5%; and high HIV-1 sub-region when HIV-1 prevalence over 5%. See table 3.4.

Table 3.4 HIV-1 prevalence and surveillance sites in sub-region

<i>Region (HIV prevalence)</i>	<i>Sub-region</i>	<i>Surveillance sites (HIV prevalence)</i>	<i>HIV prevalence in sub-region</i>
East (2.3%)	Low	Liaoning Fushun (0%), Hebei Shijiazhuang (0%), Zhejiang Hangzhou (0%)	0%
	High	Guangdong Dongguan (5.9%)	5.9%
Central (2.4%)	Low	Anhui Huainan (0%), Anhui Maanshan (0.7%), Hubei Xiaogan (0.9%), Hubei Jingzhou (0.5%)	0.6%
	High	Chongqing (7.3%)	7.3%
West and South-West (7.0%)	Low	Guizhou Qianxinan (0.4%), Sichuan Dazhou (0.4%), Gansu Dingxi (0%), Gansu Wuwei (0%), Qinghai Haidong (0.6%), Qinghai Haixi (0%), Guizhou Tongren (4.5%), Xinjiang Yili (0%), Sichuan Leshan (2.6%),	1.0%
	High	Guangxi nanning (21.0%), Sichuan Liangshan (29.4%), Xinjiang Kashi (10.8%)	21.4%

Sites which HIV-1 prevalence lower than 5% were categorized into HIV-1 lower region, and sites which HIV-1 prevalence equal or higher than 5% were categorized into HIV-1 higher region. after the categorization, there were much few HIV-1 positives in low regions, totally 31 (0.8%); all sites which HIV-1 prevalence over 5% were reordered to higher prevalence regions, it included Guangxi nanning (21.0%), Sichuan Liangshan (29.4%), Xinjiang Kashi (10.8%), Chongqing (7.3%), Guangdong Dongguan (5.9%). HIV-1 prevalence in higher regions was 15.0% (266/1778).

Table 3.5 Prevalence of HIV-1 and syphilis in target populations

<i>Variables</i>	Total (5890) (%)	East coast (n=1063) (%)	Central (n=1383) (%)	west and South-West (n=3444) (%)	<i>P</i> *
HIV+	5.0	2.3	2.4	7.0	<0.001
Syphilis+	2.8	3.7	0.6	3.3	<0.001
HIV+ and syphilis+	0.6	0.1	0.0	1.0	<0.001
HIV- and syphilis+	2.1	3.6	0.6	2.3	<0.001
HIV+ and syphilis-	4.4	2.2	2.4	6.0	<0.001

There were totally 36 samples who both HIV-1 and syphilis tests were positive, 261 samples were HIV-1 positive and syphilis negative, and 126 samples were syphilis positive and HIV-1 negative. (Table 3.5)

### 3.1.3 Behaviour

#### Drug use behaviour

79.4% samples first used drug at younger than 30, 13.3% first used drug at elder than 30. 51.5% samples once injected drug. 25.2% samples once injected in last one month. 40.9% samples first injecting age were equal or younger than 30, 8.8% elder than 30. 22.7% samples once shared needles, 7.2% samples shared needles by latest injecting, 6.5% samples shared needles by latest one month. 16.0% samples ever shared needles in last 6 months.

#### Sex behaviour

45.8% samples have had sex in last month, 41.5% samples used condom by latest sex, 12,7% samples have had any commercial sex (paying or offer) in last one year, 4.7% samples used condom by latest commercial sex, 13.1% samples have had STD symptoms in last 1 year (emission ache/burn, urethra/vagina secretion abnormal, genitals derma trauma/hyperplasia).

### **3.1.4 Other information**

#### **Knowledge about HIV transmission**

Knowledge about HIV transmission means object knew the three transmission ways of HIV, e.g. blood transmission, sexual transmission and mother to child transmission.

It includes five questions:

- can a person be infected with HIV through transfusion HIV infected blood or blood product?
- can a person be infected HIV if he/she shares needles with HIV infected person?
- can the risk of transmission HIV decrease if condom is used properly by sex at every time?
- can the risk of transmission HIV decrease if you have a non-infected fix sex partner?
- can a HIV infected pregnant woman transmit HIV virus to her unborn child?

57.6% samples knew all HIV transmission ways, 7.6% samples did not know any HIV transmission way.

#### **Information about receive HIV test**

22.0% samples reported once tested HIV and knew results.

#### **Information about intervention program**

25.6% samples reported once got any intervention services in different way.

Intervention services include needle exchange/clean needle distribution, methadone replacement treatment, partner education, condom distribution, HIV counselling and test, and AIDS/STD brochures.

### 3.2 Sample Characteristics in Different Geographic Regions

All 21 drug use sites were categorized into three groups according to geographical and economical difference, i.e. east coast, central, west and south-west regions.

1. East coast: Liaoning (Fushan), Hebei (shijiazhaung), Zhejiang (Hangzhou), Guangdong (Dongguan)
2. Central region: Anhui (Huainan, Maanshan), Hubei (Xiaogan, Jingzhou), Chongqing
3. West and South-West: Guangxi (Nanning), Guizhou (Tongren, Qianxinan), Sichuan (Dazhou, Leshan, Liangshan), Gansu (Dingxi, Wuwei), Qinghai (Haidong, Haixi), Xingjiang (Kashi, Yili)

The most samples (87.5%) in east region were from detoxification center, in central and west and south-west regions were a bit more or less than 50%. Male accounted a big part of samples, the proportion of male in all three regions was over 80%; more dug users in east and west and south-west regions were younger than 30, on the contrary, most drug users in central region were elder than 30; most drug users lived without partner in all three regions. Over 90% of drug users in central and west and south-west regions were local resident, however, the proportion of transient residents in east coast is over 50%, it is also coincident with the regional economics, most floating workers migrate into east coast regions. Over 90% of drug users in east coast and central regions were Han-Chinese, however, the proportion of minorities in west and south-west was over 50%, it is also coincident with the geographic distribution of Chinese nations, there were 55 minorities in China, most populous minorities locate in west and south-west regions, e.g. Uigur, Zhuang, Tibetan, etc (*National Bureau of Statistics, China; 2005*). Over 50% samples got more than 9 years education in all three regions, the proportion of samples that got education more than 9 years was even more than 80% in central regions. Over 50% samples were blue-collar worker in all three regions, the proportion of samples that blue collar worker was more than 80% in central regions. Almost 50% samples in central and west and south-west

regions earned equal or less than 600 RMB, whereas, only 14.4% samples in east coast earned equal or less than 600 RMB. See table 3.6.

Table 3.6 Demographic characteristics of the surveillance samples in different geographic regions

Variables		Total (5890) (%)	East coast (n=1063) (%)	Central (n=1383) (%)	west and South- West (n=3444) (%)	P*
Sample source	detoxification center	55.8	87.5	41.9	51.7	<0.001
	community	30.9	8.9	27.9	38.9	
	others	12.7	2.6	29.9	8.9	
Gender	male	84.4	81.8	82.9	85.8	0.005
	female	15.2	17.6	16.9	13.9	
Age	<30	51.9	58.2	45.8	52.4	<0.001
	>30	48.0	41.7	54.1	47.5	
Marital status	live without partner	54.2	60.1	57.3	51.2	<0.001
	live with partner	44.8	38.5	41.8	47.9	
Resident place	local	84.4	46.8	93.9	92.1	<0.001
	transient	14.8	52.4	5.4	7.1	
Nation	Han	72.9	91.0	97.2	57.6	<0.001
	minority	25.2	6.7	1.4	40.5	
Education	<= 9 years	32.4	28.2	13.7	41.2	<0.001
	> 9 yeas	65.4	69.6	84.8	56.3	
Profession	white collar	32.7	28.4	14.8	41.2	<0.001
	blue collar	64.1	64.3	81.9	56.9	
	missing	3.2	7.2	3.3	1.9	
monthly income	<600	40.7	14.4	46.2	46.7	<0.001
	601-2000	20.9	21.5	16.3	22.6	
	>2000	5.8	19.2	4.2	2.3	
	missing <sup>1</sup>	32.5	44.9	33.3	28.4	

\*Pearson Chi-Square

<sup>1</sup> 32.5% were missing values in this category

The most drug users used drug at younger than 30, 76.2%, 80.2%, and 80.1% in east coast, central, and west and south-west regions, respectively. The proportion of IDU was 72.0% in central regions, 62.6% in east coast, and 39.8% in west and south-west. The proportion of needle sharing among IDU was 34.4% in central regions, 42.5% in east coast, and 49.9% in west and south-west. The proportion of IDU among drug users was quite lower in west and south-west regions in comparison to other two regions, however, needle sharing rate was the highest in west and south-west regions, and most HIV infections were found there. See table 3.7.

Table 3.7 Drug using behavioral characteristics of the surveillance samples in different geographic regions

Variables			Total (5890) (%)	East coast (n=1063) (%)	Central (n=1383) (%)	west and South- West (n=3444) (%)	P*
first drug use age	<30		79.4	76.2	80.2	80.1	<0.001
	>30		13.3	11.6	13.7	13.7	
	missing		7.3	12.2	6.1	6.2	
Ever injected	No		46.1	35.0	27.4	57.1	<0.001
	Yes		51.5	62.6	72.0	39.8	
Number of IDU			3033	665	996	1372	
IDU	age first inject	<30	78.3	75.5	75.9	81.4	<0.001
		>30	16.8	13.5	21.0	15.4	
		not remember	3.1	7.4	1.9	1.9	
	injected in last month	No	51.1	54.3	61.9	41.8	<0.001
		Yes	48.9	45.7	38.1	58.2	
	ever shared needles	No	55.9	65.6	57.5	50.1	<0.001
Yes		44.1	34.4	42.5	49.9		
Number of sharing needles in IDU			1337	229	423	685	
IDU share needles	share needles by latest injecting	No	68.4	65.5	66.9	70.4	0.279
		Yes	31.6	34.5	33.1	29.6	
	share needles by latest one month	No	71.2	68.1	69.7	73.1	0.252
		Yes	28.8	31.9	30.3	26.9	
	share needles in last 6 months	No	30.7	38.4	31.4	27.6	0.008
		Yes	69.3	61.6	68.6	72.4	

\*Pearson Chi-Square

46.5% samples in east coast have had sex in last month, and 47.4% and 44.9% in central and west and south-west regions, respectively. The proportion of who engaged commercial sex in last year was 12.8%, 16.6%, and 11.1% in east coast, central, and west and south-west region, respectively. The rate of condom use by last commercial sex was over 50% in east coast (52.9%), whereas, significantly lower in central and west and south-west regions, 37.0% and 31.1% respectively. The proportion of who have had STD symptoms (emission ache/burn, urethra/vagina secretion abnormal, genitals derma trauma/hyperplasia) in last one year was 15.2%, 14.7%, and 11.8% in east coast, central, and west and south-west regions, respectively. See Table 3.8.

Table 3.8 Sexual behavioral characteristics of the surveillance samples in different geographic regions

Variables		Total (5890) (%)	East coast (n=1063) (%)	Central (n=1383) (%)	west and South- West (n=3444) (%)	P*
have had sex in last month	No	52.5	48.0	51.8	54.2	<0.001
	Yes	45.8	46.5	47.4	44.9	
Number who had sex in last month		2695	494	655	1546	
have had sex in last month used condom by latest sex	No	9.2	15.6	4.9	9.0	0.001
	Yes	90.8	84.4	95.1	91.0	
any commercial sex in last one year	No	87.3	87.2	83.4	88.9	<0.001
	Yes	12.7	12.8	16.6	11.1	
Number who had commercial sex in last one year		749	136	230	383	
any commercial sex in last one year Use condom by latest commercial sex	No	63.2	47.1	63.0	68.9	<0.001
	Yes	36.8	52.9	37.0	31.1	
STD symptoms in last 1 year	No	84.3	77.3	84.0	86.6	<0.001
	Yes	13.1	15.2	14.7	11.8	

\*Pearson Chi-Square



The proportion of samples who knew all three transmission ways of HIV infection was all over 50% in three regions, 55.0%, 72.7%, and 52.3% in east coast, central, and west and south-west regions, respectively. 22.2% samples in east coast once tested HIV and knew the result, 20.2% and 22.6% in central and west and south-west regions, respectively. The proportion of samples who received any intervention service in last one year was lower than 35% in all three regions. See table 3.9.

Table 3.9 Other characteristics of the surveillance samples in different geographic regions

Variables		Total (5890) (%)	East coast (n=1063) (%)	Central (n=1383) (%)	west and South- West (n=3444) (%)	P*
once tested HIV and knew result	No	78.0	77.8	79.8	77.4	0.175
	Yes	22.0	22.2	20.2	22.6	
Knowledge about all HIV transmission	Not know	7.6	5.7	2.8	10.0	<0.001
	Know 20%	2.6	2.3	0.6	3.6	
	Know 40%	4.2	3.5	1.9	5.3	
	Know 60%	8.7	7.7	4.8	10.5	
	Know 80%	19.4	25.8	17.2	18.3	
	Know all	57.6	55.0	72.7	52.3	
Once received any intervention service	No	74.4	79.0	66.8	76.0	<0.001
	Yes	25.6	21.0	33.2	24.0	

\*Pearson Chi-Square

### HIV infection in different geographic regions

The prevalence of HIV in east coast, central and west and south-west regions was 2.3% (24/1063), 2.4% (33/1383), and 7.0% (240/3444), respectively. The prevalence of HIV in west and south-west regions was over 5%, and most higher HIV prevalence regions were located in west and south-west in China (*China CDC, 2005*).

### **3.3 Sample Characteristics in Different HIV Prevalence Regions**

Every single site was categorized into two groups according to the HIV prevalence tested in target populations, low HIV region when HIV prevalence below 5%; and high HIV region when HIV prevalence over 5%. After the categorization, there were much few HIV positives in low regions, totally 31 (0.8%); all sites which HIV prevalence over 5% were reordered to higher prevalence regions, it included Guangxi nanning (21.0%), Sichuan Liangshan (29.4%), Xinjiang Kashi (10.6%), Chongqing (7.3%), Guangdong Dongguan (5.8%). HIV prevalence in higher regions was 15.0% (266/1778).

The samples from detoxification center were over 50% in HIV lower and higher regions, 52.4% and 64.9% respectively; 38.5% samples in lower regions were from community, whereas, the proportion of samples from community in higher regions was quite lower, only 14%. Male accounted a big part of samples, the proportion of male in both regions was over 80%; more drug users in higher regions were younger than 30 (57.3%), on the contrary, drug users in lower regions that elder or younger than 30 almost the same proportion. Over 50% drug users lived without partner in both regions. Over 80% of drug users in both regions were local resident. Over 80% of drug users in lower regions were Han-Chinese, however, the proportion of minorities in higher regions is 44.5%. 72.7% samples got more than 9 years education in lower regions, it was only 53.5% in higher regions. The most samples were blue-collar worker, 69.1% and 59.7% in lower and higher regions respectively. Over 50% samples in higher regions earned equal or less than 600 RMB, whereas, only 36.7% samples in east coast earned equal or less than 600 RMB. See table 3.10.

Table 3.10 Demographic characteristics of the samples in different HIV prevalence regions

Variables		lower regions (4112)	Higher regions (1778)	total (5890)	p*
Sample source	detoification center	52.4	64.9	55.8	<0.001
	community	38.5	14.0	30.9	
	others	9.1	21.1	12.7	
Gender	male	83.5	87.5	84.4	<0.001
	female	16.5	12.5	15.2	
Age	<30	49.6	57.3	51.9	<0.001
	>30	50.4	42.7	48.0	
Marital status	live alone	52.9	59.0	54.2	<0.001
	live with partner	47.1	41.0	44.8	
Resident place	local	85.9	83.1	84.4	0.007
	transient	14.1	16.9	14.8	
Nation	Han	82.5	55.5	72.9	<0.001
	minority	17.5	44.5	25.2	
Education	<= 9 years	27.3	46.5	32.4	<0.001
	> 9 years	72.7	53.5	65.4	
Profession	white collar	30.9	40.3	32.7	<0.001
	blue collar	69.1	59.7	64.1	
monthly income	<600	36.7	50.1	40.7	<0.001
	601-2000	22.2	18.0	20.9	
	>2000	4.7	8.3	5.8	
	missing <sup>1</sup>	36.4	23.6	32.5	

\*Pearson Chi-Square

<sup>1</sup> 32.5% were missing values in this category

The most drug users used drug at younger than 30, 77.6% and 83.6% in lower and higher regions, respectively. The proportion of IDU was 48.9% in lower regions, 61.5% in higher regions. The proportion of IDU and needle sharing was 20.1% in lower regions and 30.3% in higher regions. 45.1% samples in lower regions have had sex in last month, and 49.9% in higher regions, respectively. The proportion of who engaged commercial sex in last year was 11.8% and 14.7% in lower and higher regions, respectively. The proportion of who have had STD symptoms (emission ache/burn, urethra/vagina secretion abnormal, genitals derma trauma/hyperplasia) in last one year was 12.1% and 16.4% in lower and higher regions, respectively. See table 3.11.

Table 3.11 Risk behavioral characteristics of the samples in HIV prevalence regions

Variables		lower regions (4112)	Higher regions (1778)	total (5890)	p*
first drug use age	<30	77.6	83.6	79.4	<0.001
	>30	13.0	14.1	13.3	
	misssing <sup>1</sup>	9.4	2.3	7.3	
IDU	No	51.1	38.5	47.3	<0.001
	Yes	48.9	61.5	52.7	
IDU and share needles	No IDU	51.1	38.5	47.3	<0.001
	IDU no share needles	28.7	31.2	29.5	
	IDU shwere needles	20.1	30.3	23.2	
IDU share needles in last 6 months	No IDU	51.1	38.5	47.3	<0.001
	IDU no share needles	28.7	31.2	29.5	
	share needles but not in last 6 months	6.8	8.0	7.1	
	share needles in last 6 months	13.4	22.3	16.1	
have had sex in last month	No	54.9	50.1	53.4	0.001
	Yes	45.1	49.9	46.6	
had sex and condom use	no sex	54.9	50.1	53.4	0.003
	had sex with condom	40.9	45.4	42.3	
	had sex no condom	4.2	4.5	4.3	
commercial sex in last one year	No	88.2	85.3	87.3	0.002
	Yes	11.8	14.7	12.7	
STD symptoms in last 1 year	No	87.9	83.6	86.5	<0.001
	Yes	12.1	16.4	13.5	

\*Pearson Chi-Square

<sup>1</sup> 7.3% were missing values in this category

The proportion of samples who knew all three transmission ways of HIV infection was all over 50% in both regions, 60.2% and 51.6% in lower and higher regions, respectively. 22.5% samples in lower regions once tested HIV and knew the result, 20.6% in higher regions. The proportion of samples who received any intervention service in last one year was lower, 25.5% and 26.0% in lower and higher regions respectively. See table 3.12.

Table 3.12 Other characteristics of the samples in different HIV prevalence regions

<i>Variables</i>		<i>lower regions (4112)</i>	<i>Higher regions (1778)</i>	<i>total (5890)</i>	<i>p*</i>
once tested HIV and knew result	No	77.5	79.4	78.0	0.105
	Yes	22.5	20.6	22.0	
Knowledge about all HIV transmission	Not know	4.7	14.1	7.6	<0.001
	Know 20%	3.0	1.7	2.6	
	Know 40%	4.2	4.2	4.2	
	Know 60%	9.3	7.3	8.7	
	Know 80%	18.6	21.1	19.4	
	Know all	60.2	51.6	57.6	
any intervention service in last one year	No	74.5	74.0	74.4	0.641
	any	25.5	26.0	25.6	

\*Pearson Chi-Square

### **3.4 Bivariate Analysis of Sample Characteristics and HIV and Syphilis Infection**

Bivariate analysis ( $\chi^2$  statistics with *P*-values) was used to compare HIV and syphilis prevalence associated with demographics, drug use and sexual risk behaviours.

$X^2$  analysis for demographic and socio-economic factors showed that HIV prevalence was significant associated with sample source ( $p < 0.01$ ), age ( $p < 0.05$ ), resident place ( $p < 0.001$ ), nation ( $p < 0.001$ ), education ( $p < 0.001$ ), profession ( $p < 0.001$ ), monthly income ( $p < 0.001$ ). Risk factors among demographic and socio-economic characters were sample from detoxification center or other sources, male drug users, age younger than 30, local resident, minority, education equal or less than 9 years, white collar, and monthly income equal or less than 600 RMB. See table 3.13.

Table 3.13 Bivariate analyse of demographic and socio-economic characteristics of the samples in relation to HIV infection

Variables		HIV <sup>+</sup> 297 (5.0%)	p*
Sample source	detoxification centre	5.5	0.004
	community	3.7	
	others	6.6	
Gender	male	5.1	0.541
	female	4.9	
Age	<30	5.8	0.030
	>30	4.3	
Marital status	live without partner	4.8	0.566
	live with partner	5.3	
Resident place	local	5.6	<0.001
	transient	2.3	
Nation	Han	2.8	<0.001
	minority	11.9	
Education	<= 9 years	8.4	<0.001
	> 9 years	3.3	
Profession	white collar	8.1	<0.001
	blue collar	3.6	
Monthly income	<600	6.4	<0.001
	601-2000	4.5	
	>2000	2.1	
	Missing <sup>1</sup>	4.2	

\*Pearson Chi-Square

<sup>1</sup> 32.5% were missing values in this category

$X^2$  analysis for behavioral factors showed that HIV prevalence was significant associated with first drug use age ( $p=0.001$ ), IDU and share needles ( $p<0.001$ ). risk factors among behavioral characters were first drug use age younger than 30, IDU share needles. See table 3.14.

Table 3.14 Bivariate analyse of behavioral characteristics of the samples in relation to HIV infection

Variables		HIV <sup>+</sup> 297 (5.0%)	p*
first drug use age	<30	5.5	0.001
	>30	4.1	
IDU and share needles	No IDU	3.5	<0.001
	IDU no share needles	4.6	
	IDU share needles	9.2	
Number of commercial sex partner in last 1 year	no commercial sex	5.1	0.285
	<=10	8.8	
	>10	8.3	
commercial sex in last one year	No	5.1	0.621
	Yes	4.7	
STD symptoms in last 1 year	No	5.0	0.253
	Yes	6.1	

\*Pearson Chi-Square

X<sup>2</sup> analysis for demographic and socio-economic factors, drug use behaviours and sexual behaviours showed that syphilis prevalence was significant associated with sample source (p<0.001), gender (p<0.001), marital status (p<0.05), resident place (p<0.05), nation (p=0.001), education (p=0.001), IDU (p<0.001), number of commercial sex partner in last 1 year (p<0.001), STD symptoms in last 1 year (p<0.001). Risk factors among demographic and behavioral characters were sample from detoxification center, female drug users, live with partner, transient resident, minority, education equal or less than 9 years, IDU, have had commercial sex partner in last 12months, and have had STS symptoms in last 12 months. See table 3.15.



Table 3.15 Bivariate analyse of demographic and behavioral characteristics of the samples in relation to syphilis infection

Variables		syphilis <sup>+</sup> 162 (2.8%)	p*
Sample source	detoxification center	4.0	<0.001
	community	1.3	
	others	0.9	
Gender	male	1.8	<0.001
	female	8.0	
Age	<30	3.2	0.056
	>30	2.2	
Marital status	live without partner	2.3	0.038
	live with partner	3.3	
Resident place	local	2.5	0.048
	transient	4.0	
Nation	Han	2.4	0.001
	minority	4.0	
Education	<= 9 years	3.9	0.001
	> 9 years	2.2	
Profession	white collar	2.9	0.062
	blue collar	2.8	
Monthly income	<600	2.9	0.340
	601-2000	2.4	
	>2000	4.1	
	missing <sup>1</sup>	2.6	
IDU	No	1.9	<0.001
	Yes	3.7	
Number of commercial sex partner in last 1 year	no commercial sex	2.6	<0.001
	<=10	10.0	
	>10	41.7	
commercial sex in last one year	No	2.6	0.077
	Yes	3.7	
STD symptoms in last 1 year	No	2.6	0.017
	Yes	4.1	

\*Pearson Chi-Square

<sup>1</sup> 32.5% were missing values in this category

### 3.5 Logistic Regression of Sample Characteristics and HIV and Syphilis Infection

Logistic regression was used to analyse independent association between HIV and syphilis status and demographic factors and risk behaviours.

At first, logistic regression was used to analyse independent association between HIV and syphilis infection, and demographic and socio-economic characters.

Based on logistic regression analysis, demographic factors significantly associated with HIV prevalence were shown in Table 3.16: minority versus Han-Chinese (OR 3.38; 95% CI 2.53-4.52;  $p < 0.001$ ), education  $\leq 9$  years versus  $> 9$  years (OR 1.47; 95% CI 1.11-1.95;  $p < 0.01$ ), profession white collar versus blue collar (OR 1.42; 95% CI 1.07-1.88;  $p < 0.05$ ), resident place local vs. transient (OR 1.96; 95% CI 1.19-3.24;  $p < 0.01$ ). See Table 3.16.

Table 3.16 Logistic regression analysis of the socio-demographic factors associated with HIV<sup>+</sup>

		OR	95.0% C.I.		p
			Lower	Upper	
Sample source	community vs. detoxification center	0.78	0.58	1.05	0.105
	others vs. detoxification center	1.05	0.74	1.49	0.777
Gender	female vs. male	1.35	0.95	1.93	0.097
Age	<30 vs. >30	1.11	0.85	1.45	0.433
Marital status	live alone vs. live with partner	1.09	0.84	1.42	0.504
Resident place	local vs. transient	1.96	1.19	3.24	0.009
Nation	Minority vs. Han	3.38	2.53	4.52	<0.001
Monthly income	601-2000 vs. <600	0.89	0.63	1.24	0.484
	>2000 vs. <600	0.48	0.20	1.12	0.088
	Missing <sup>1</sup> vs. <600	1.04	0.77	1.41	0.796
Profession	white collar vs. blue collar	1.42	1.07	1.88	0.014
Education	$\leq 9$ years vs. $> 9$ years	1.47	1.11	1.95	0.007

<sup>1</sup>32.5% were missing values in this category

Based on logistic regression analysis, demographic factors significantly associated with syphilis prevalence were shown in Table 3.17: sample source detoxification center versus others (OR 3.78; 95% CI 1.73-8.24;  $p=0.001$ ), gender female versus male (OR 6.06; 95% CI 4.25-8.65;  $p<0.001$ ), marital status live with partner versus live alone (OR 1.46; 95% CI 1.03-2.07;  $p<0.05$ ), minority versus Han-Chinese (OR 1.87; 95% CI 1.27-2.75;  $p<0.01$ ), education  $\leq 9$  years versus  $>9$  years (OR 2.09; 95% CI 1.45-3.02;  $p<0.001$ ), profession blue collar versus white collar (OR 1.47; 95% CI 1.01-2.15;  $p<0.05$ ), resident place local vs. transient. See Table 3.17.

Table 3.17 Logistic regression analysis of the socio-demographic factors associated with syphilis

		OR	95.0% C.I.		p
			Lower	Upper	
Sample source	detoxification center vs. Other	3.78	1.73	8.24	0.001
	community vs. Other	1.41	0.60	3.33	0.427
Gender	female vs. male	6.06	4.25	8.65	<0.001
Age	<30 vs. >30	1.11	0.78	1.59	0.558
Marital status	live with partner vs. live alone	1.46	1.03	2.07	0.032
Resident place	local vs. transient	0.80	0.52	1.24	0.321
Nation	Minority vs. Han	1.87	1.27	2.75	0.002
Monthly income	601-2000 vs. <600	0.78	0.48	1.26	0.305
	>2000 vs. <600	1.40	0.73	2.67	0.307
	Missing <sup>1</sup> vs. <600	0.82	0.55	1.23	0.335
Profession	blue collar vs. white collar	1.47	1.01	2.15	0.043
Education	$\leq 9$ years vs. $> 9$ years	2.09	1.45	3.02	<0.001

<sup>1</sup> 32.5% were missing values in this category

Based on logistic regression analysis, demographic and behavioral factors significantly associated with HIV prevalence were shown in Table 3.18: minority versus Han-Chinese (OR 4.10; 95% CI 3.03-5.55;  $p<0.001$ ), education  $\leq 9$  years versus  $>9$  years (OR 1.61; 95% CI 1.20-2.15;  $p=0.001$ ), profession white collar versus blue collar (OR 1.69; 95% CI 1.25-2.27;  $p=0.001$ ), injecting drugs without needle-sharing versus not injecting (OR 2.49; 95% CI 1.77-3.52;  $p<0.001$ ), injecting drugs

with needle-sharing versus not injecting (OR 4.44; 95% CI 3.19-6.19;  $p < 0.001$ ). See table 3.18.

Table 3.18 Logistic regression analysis of all factors associated with HIV<sup>+</sup>

		<i>p</i>	<i>OR</i>	<i>95% C.I.</i>	
				Lower	Upper
Sample source	community vs. detoxification center	0.105	0.77	0.56	1.06
	others vs. detoxification center	0.806	0.96	0.66	1.38
Gender	female vs. male	0.335	1.21	0.82	1.78
Age	>30 vs. <30	0.706	0.94	0.70	1.28
Marital status	live with partner vs. live alone	0.913	0.98	0.75	1.29
Resident place	local vs. transient	0.061	1.64	0.98	2.76
Nation	Minority vs. Han	<0.001	4.10	3.03	5.55
Education	<=9 years vs. >9 years	0.001	1.61	1.20	2.15
Profession	white collar vs. blue collar	0.001	1.69	1.25	2.27
	601-2000 vs. <600	0.494	0.89	0.62	1.25
Monthly income	>2000 vs. <600	0.044	0.41	0.17	0.98
	missing <sup>1</sup> vs. <600	0.527	1.11	0.81	1.52
First drug use age	>30 vs. <30	0.474	0.85	0.54	1.33
IDU and share needles	IDU no share needles vs. Non-IDU	<0.001	2.49	1.77	3.52
	IDU share needles vs. Non-IDU	<0.001	4.44	3.19	6.19
frequency of use condom by commercial sex in last 1 year	never use vs. no commercial sex	0.533	1.62	0.36	7.36
	occasionally vs. no commercial sex	0.659	1.32	0.38	4.59
	every time vs. no commercial sex	0.991	0.99	0.17	5.71
STD symptoms in last 1 year	Yes vs. No	0.231	0.80	0.55	1.16

<sup>1</sup> 32.5% were missing values in this category

Based on logistic regression analysis, demographic and behavioral factors significantly associated with syphilis prevalence were shown in Table 3.19: sample source detoxification center versus others (OR 3.49; 95% CI 1.59-7.66;  $p < 0.01$ ), gender female versus male (OR 5.14; 95% CI 3.49-7.56;  $p < 0.001$ ), minority versus Han-Chinese (OR 1.89; 95% CI 1.26-2.83;  $p < 0.01$ ), education <=9 years versus >9 years (OR 2.27; 95% CI 1.55-3.32;  $p < 0.001$ ), injecting drugs without needle-sharing

versus not injecting (OR 1.70; 95% CI 1.10-2.64;  $p < 0.05$ ), injecting drugs with needle-sharing versus not injecting (OR 2.17; 95% CI 1.39-3.39;  $p = 0.001$ ). See table 3.19.

Table 3.19 Logistic regression analysis of all factors associated with syphilis

		OR	95.0% C.I.		p
			Lower	Upper	
sample source	detoxification center vs. Other	3.49	1.59	7.66	0.002
	community vs. Other	1.27	0.53	3.02	0.590
Gender	female vs. male	5.14	3.49	7.56	<0.001
Age	<30 vs. >30	0.93	0.62	1.38	0.705
marital status	live with partner vs. live alone	1.42	0.99	2.03	0.058
Resident place	local vs. transient	0.72	0.46	1.13	0.154
Nation	Minority vs. Han	1.89	1.26	2.83	0.002
Monthly income	601-2000 vs. <600	0.71	0.43	1.18	0.183
	>2000 vs. <600	1.07	0.53	2.16	0.853
	Missing <sup>1</sup> vs. <600	0.97	0.64	1.47	0.893
Profession	blue vs. white	1.24	0.84	1.85	0.280
Education	<= 9 years vs. > 9 years	2.27	1.55	3.32	<0.001
first drug use age	>30 vs. <30	0.60	0.31	1.17	0.134
IDU and share needles	IDU no share needles vs. Non-IDU	1.70	1.10	2.64	0.017
	IDU share needles vs. Non-IDU	2.17	1.39	3.39	0.001
frequency of use condom by commercial sex in last 1 year	never use vs. No sex	0.60	0.11	3.36	0.563
	occasionally vs. No sex	1.34	0.37	4.86	0.658
	every time vs. No sex	2.47	0.65	9.36	0.185
STD symptoms in last 1 year	Yes vs. No	1.14	0.72	1.81	0.570

<sup>1</sup> 32.5% were missing values in this category

### **3.6 Sample Characters of Higher HIV-1 Prevalence Sites in Higher HIV-1 Prevalence Regions**

The major mode of HIV infection in the four provinces with the highest reported cases of HIV/AIDS, including Yunnan, Xinjiang, Guangxi and Sichuan, is attributed to injection drug use (MOH, China/WHO, 2004 & China CDC, 2003). In this study, the characteristics of the sentinel sites located in abovementioned provinces which HIV-1 prevalence was higher than 5% were listed below. See Table 3.20

In this study, the sentinel sites which the HIV-1 prevalence was over 5% in abovementioned higher prevalence regions were Guangxi Nanning 21.0%, Xinjiang Kashi 10.8%, Sichuan Liangshan 29.4%, respectively; in which HIV-1 prevalence among IDU in these sites were 20.9% in Guangxi Nanning, 38.0% in Sichuan Liangshan, and 32.7% in Xinjiang Kashi, respectively.

The most samples (99.3%) in Xinjiang Kashi were from detoxification center, in Guangxi Nanning over half of samples were from community (60.8%), and in Sichuan Liangshan over half of samples were from detoxification center (57.0%). Male accounted a enormously big part of samples in Sichuan Liangshan and Xinjiang Kashi, 93.2% and 96.6% respectively; whereas in Guangxi Nanning, male to female ratio was almost 1:1. More drug users in Sichuan Liangshan and Xinjiang Kashi were younger than 30, on the contrary, most drug users in Guangxi Nanning were elder than 30. Over 98% of drug users in Guangxi Nanning and Sichuan Liangshan were local resident, in Xinjiang Kashi all samples were local resident. Over 90% of drug users in Sichuan Liangshan and Xinjiang Kashi were minorities, however, the proportion of Han-Chinese in Guangxi Nanning was over 80%. Over 70% samples got more than 9 years education in Guangxi Nanning, whereas, Over 80% samples got less than 9 years education in Sichuan Liangshan. Most drug users use drug at younger than 30, 97.6% drug users in Guangxi Nanning were IDUs, only 36.2% and 17.6% samples were IDUs in Sichuan Laingshan and Xinjiang Kashi respectively.

Most samples have had no commercial sex in last 12 months, and have had no STD symptoms in last 12 months. See Table 3.20.

Table 3.20 Characteristics of samples in Guangxi Nanning, Sichuan Liangshan, and Xinjiang Kashi

Variables		Guangxi Nanning (N=291) %	Sichuan Liangshan (N=415) %	Xinjiang Kashi (N=297) %
Sample source	detoification center	39.2	57.0	99.3
	community	60.8	16.9	0.7
	others	0.0	26.1	0.0
Gender	male	50.9	93.2	96.6
	female	49.1	6.8	3.4
Age	<30	43.6	66.0	71.7
	>30	56.4	34.0	28.3
Marital status	live alone	63.6	34.4	52.2
	live with partner	36.4	65.6	47.8
Resident place	local	98.6	99.8	100
	transient	1.4	0.2	0.0
Nation	Han	82.7	5.1	1.7
	Minority	17.3	94.9	98.3
Education	<= 9 years	25.1	84.7	55.4
	> 9 years	74.9	15.3	44.6
Monthly income	<600	40.5	63.1	85.2
	601-2000	9.6	10.1	9.1
	>2000	3.4	1.4	1.3
	missing	46.4	25.3	4.4
First drug use age	<30	90.6	82.4	83.7
	>30	9.4	17.6	16.3
IDU	No	2.4	63.8	82.4
	Yes	97.6	36.2	17.6
commercial sex in last 12 months	No	90.0	90.1	94.9
	Yes	10.0	9.9	5.1
STD symptoms in last 12 months	No	86.6	80.9	93.5
	Yes	13.4	19.1	6.5

Based on logistic regression analysis, no demographic and behavioral factors significantly associated with HIV-1 prevalence in Guangxi Nanning. See table 3.21.

Table 3.21 Logistic regression analysis of sample characteristics associated with HIV<sup>+</sup> in Guangxi Nanning (HIV-1 prevalence 21.0%)

		<i>P</i>	<i>OR</i>	<i>95% C.I.</i>	
				Lower	Upper
Sample source	detoxification center vs. community	0.357	1.77	0.53	5.95
Gender	male vs. female	0.530	1.46	0.45	4.72
Age	<30 vs. >30	0.643	0.86	0.46	1.62
Marital status	live alone vs. live with partner	0.226	1.54	0.77	3.08
Resident place	local vs. transient	0.412	0.32	0.02	4.87
Nation	Han vs. Minority	0.599	1.26	0.54	2.93
Education	>9 years vs. <9 years	0.816	1.09	0.53	2.22
Monthly income	601-2000 vs. <600	0.587	1.34	0.46	3.90
	>2000 vs. <600	0.366	0.35	0.04	3.39
	Missing <sup>1</sup> vs. <600	0.830	0.93	0.47	1.83
First drug use age	<30 vs. >30	0.270	2.09	0.57	7.74
IDU	yes vs. no	0.558	2.08	0.18	24.18
Commercial sex in last 12 months	yes vs. no	0.277	1.67	0.66	4.18
STD symptoms in last 12 months	yes vs. no	0.933	0.96	0.38	2.41

<sup>1</sup> 46.4% were missing values in this category



Based on logistic regression analysis, demographic and behavioral factors significantly associated with HIV prevalence in Sichuan Liangshan were shown in Table 3.18: minority versus Han-Chinese (OR 9.96; 95% CI 1.24-80.26;  $p < 0.05$ ), IDU versus Non-IDU (OR 1.94; 95% CI 1.21-3.11;  $p < 0.01$ ). See table 3.22.

Table 3.22 Logistic regression analysis of sample characteristics associated with HIV<sup>+</sup> in Sichuan Liangshan (HIV-1 prevalence 29.4%)

		<i>P</i>	<i>OR</i>	<i>95% C.I.</i>	
				Lower	Upper
Sample source	community vs. detoxification center	0.054	2.01	0.99	4.10
	others vs. detoxification center	0.072	1.72	0.95	3.11
Gender	male vs. female	0.761	0.87	0.37	2.09
Age	<30 vs. >30	0.713	0.89	0.47	1.68
Marital status	live alone vs. live with partner	0.814	0.94	0.57	1.56
Nation	Minority vs. Han	0.031	9.96	1.24	80.26
Education	>9 years vs. <9 years	0.431	0.76	0.38	1.52
Monthly income	601-2000 vs. <600	0.073	2.00	0.94	4.26
	>2000 vs. <600	0.666	0.60	0.06	6.07
	missing <sup>1</sup> vs. <600	0.507	0.83	0.49	1.43
First drug use age	<30 vs. >30	0.721	1.16	0.52	2.57
IDU	yes vs. no	0.006	1.94	1.21	3.11
Commercial sex in last 12 months	yes vs. no	0.871	1.07	0.49	2.32
STD symptoms in last 12 months	yes vs. no	0.554	0.83	0.45	1.54

<sup>1</sup> 25.3% were missing values in this category

Based on logistic regression analysis, demographic and behavioral factors significantly associated with HIV prevalence in Xinjiang Kashi were shown in Table 3.23: female versus male (OR 6.34; 95% CI 1.30-30.82;  $p < 0.05$ ), age  $< 30$  versus  $> 30$  (OR 5.71; 95% CI 1.50-21.70;  $p < 0.05$ ), live with partner versus live alone (OR 2.97; 95% CI 1.17-7.53;  $p < 0.05$ ), IDU versus Non-IDU (OR 6.25; 95% CI 2.46-15.87;  $p < 0.001$ ), have had commercial sex in last 12 months versus no commercial sex in last 12 months (OR 5.08; 95% CI 1.06-24.46;  $p < 0.05$ ). See table 3.23.

Table 3.23 Logistic regression analysis of sample characteristics associated with HIV<sup>+</sup> in Xinjiang Kashi (HIV-1 prevalence 10.8%)

		<i>P</i>	<i>OR</i>	<i>95% C.I.</i>	
				Lower	Upper
Sample source	detoxification center vs. community	0.084	0.08	0.01	1.41
Gender	female vs. male	0.022	6.34	1.30	30.82
Age	$< 30$ vs. $> 30$	0.011	5.71	1.50	21.70
Marital status	live with partner vs. live alone	0.022	2.97	1.17	7.53
Education	$> 9$ years vs. $< 9$ years	0.837	0.91	0.36	2.29
IDU	yes vs. no	$< 0.001$	6.25	2.46	15.87
Commercial sex in last 12 months	yes vs. no	0.043	5.08	1.06	24.46
STD symptoms in last 12 months	yes vs. no	0.455	0.53	0.10	2.82

### 3.7 Sample Characters of Higher Syphilis Prevalence Sites

In this study, the sentinel sites which the syphilis prevalence was over 5% were Guangxi Nanning 17.5%, Xinjiang Kashi 10.4%, Guangdong Dongguan 9.6%, respectively.

The almost all samples in Xinjiang Kashi (99.3%) and in Guangdong Dongguan (99.8%) were from detoxification center, in Guangxi Nanning over half of samples were from community (60.8%). Male accounted a enormously big part of samples in Guangdong Dongguan and Xinjiang Kashi, 89.2% and 96.6% respectively; whereas in Guangxi Nanning, male to female ratio is almost 1:1. More drug users in Guangdong Dongguan and Xinjiang Kashi were younger than 30, on the contrary, most drug users in Guangxi Nanning were elder than 30. Over 98% of drug users in Guangxi Nanning were local resident, in Xinjiang Kashi all samples were local resident; whereas, transient drug users in Guangdong Dongguan were 71.3%. Over 90% of drug users in Xinjiang Kashi were minorities, however, the proportion of Han-Chinese in Guangxi Nanning and Guangdong Dongguan were over 80%. Over 70% samples got more than 9 years education in Guangxi Nanning, whereas, Over 50% samples got less than 9 years education in Xinjiang Kashi. Most drug users use drug at younger than 30, 97.6% drug users in Guangxi Nanning were IDUs, 66.6% drug users in Guangdong Dongguan were IDUs, only 17.6% samples were IDUs in Xinjiang Kashi. Most samples have had no commercial sex in last 12 months, and have had no STD symptoms in last 12 months. See Table 3.24.

Table 3.24 Characteristics of samples in three higher syphilis sites (Guangxi Nanning, Guangdong Dongguan, and Xinjiang Kashi)

Variables		Guangxi Nanning (N=291) %	Guangdong Dongguan (N=407) %	Xinjiang Kashi (N=297) %
Sample source	detoxification center	39.2	99.8	99.3
	community	60.8	0.0	0.7
	others	0.0	0.0	0.0
Gender	male	50.9	89.2	96.6
	female	49.1	9.8	3.4
Age	<30	43.6	70.3	71.7
	>30	56.4	29.7	28.3
Marital status	live alone	63.6	63.6	52.2
	live with partner	36.4	35.4	47.8
Resident place	local	98.6	28.5	100
	transient	1.4	71.3	0.0
Nation	Han	82.7	86.2	1.7
	Minority	17.3	11.5	98.3
Education	<= 9 years	25.1	35.6	55.4
	> 9 years	74.9	63.1	44.6
Monthly income	<600	40.5	13.5	85.2
	601-2000	9.6	36.4	9.1
	>2000	3.4	27.8	1.3
	missing	46.4	22.4	4.4
First drug use age	<30	90.6	88.2	83.7
	>30	9.4	11.5	16.3
IDU	No	2.4	33.2	82.4
	Yes	97.6	66.6	17.6
commercial sex in last 12 months	No	90.0	76.9	94.9
	Yes	10.0	23.1	5.1
STD symptoms in last 12 months	No	86.6	78.1	93.5
	Yes	13.4	21.4	6.5

Based on logistic regression analysis, demographic and behavioral factors significantly associated with syphilis in Guangdong Dongguan were shown in Table 3.25: female versus male (OR 4.52; 95% CI 1.81-11.28;  $p=0.001$ ), live with partner versus live alone (OR 3.96; 95% CI 1.71-9.17;  $p=0.001$ ),  $\leq 9$  years education versus  $> 9$  years education (OR 3.12; 95% CI 1.41-6.89;  $p<0.01$ ), IDU versus Non-IDU (OR 2.81; 95% CI 1.09-7.24;  $p<0.05$ ). See table 3.25.

Table 3.25 Logistic regression analysis of sample characteristics associated with syphilis in Guangdong Dongguan (syphilis prevalence 9.6%)

		P	OR	95% C.I.	
				Lower	Upper
Gender	female vs. male	0.001	4.52	1.81	11.28
Age	<30 vs. >30	0.052	2.72	0.99	7.46
Marital status	live with partner vs. live alone	0.001	3.96	1.71	9.17
Nation	Han vs. Minority	0.122	5.21	0.64	42.12
Resident place	local vs. transient	0.418	0.67	0.26	1.75
Education	$\leq 9$ years vs. $>9$ years	0.005	3.12	1.41	6.89
Monthly income	601-2000 vs. <600	0.420	1.82	0.42	7.86
	>2000 vs. <600	0.208	2.61	0.59	11.58
	missing <sup>1</sup> vs. <600	0.155	2.93	0.67	12.93
IDU	yes vs. no	0.033	2.81	1.09	7.24
Commercial sex in last 12 months	yes vs. no	0.943	1.04	0.40	2.66
STD symptoms in last 12 months	yes vs. no	0.219	1.73	0.72	4.15

<sup>1</sup> 22.4% were missing values in this category

Based on logistic regression analysis, demographic and behavioral factors significantly associated with syphilis in Guangxi Nanning were shown in Table 3.26: female versus male (OR 8.50; 95% CI 2.51-28.78; p=0.001). See table 3.26.

Table 3.26 Logistic regression analysis of sample characteristics associated with syphilis in Guangxi Nanning (syphilis prevalence 17.5%)

		P	OR	95% C.I.	
				Lower	Upper
Sample source	detoxification center vs. community	0.502	1.41	0.52	3.88
Gender	female vs. male	0.001	8.50	2.51	28.78
Age	<30 vs. >30	0.717	0.88	0.44	1.77
Marital status	live with partner vs. live alone	0.892	1.05	0.50	2.20
Nation	Han vs. Minority	0.926	0.96	0.42	2.19
Education	<= 9 years vs. >9 years	0.073	2.12	0.93	4.82
Monthly income	601-2000 vs. <600	0.994	1.01	0.32	3.18
	>2000 vs. <600	0.575	0.60	0.10	3.53
	Missing <sup>1</sup> vs. <600	0.855	0.93	0.41	2.08
IDU	yes vs. no	0.230	0.33	0.05	2.02
Commercial sex in last 12 months	yes vs. no	0.697	1.20	0.48	2.98
STD symptoms in last 12 months	yes vs. no	0.115	2.30	0.82	6.50

<sup>1</sup> 46.4% were missing values in this category

Based on logistic regression analysis, demographic and behavioral factors significantly associated with syphilis in Xinjiang Kashi were shown in Table 3.27: female versus male (OR 7.44; 95% CI 1.40-39.57;  $p < 0.05$ ), live with partner versus live alone (OR 2.51; 95% CI 1.05-6.00;  $p < 0.05$ ), education equal or less than 9 years versus more than 9 years (OR 3.06; 95% CI 1.12-8.39;  $p < 0.05$ ). See table 3.27.

Table 3.27 Logistic regression analysis of sample characteristics associated with syphilis in Xinjiang Kashi (syphilis prevalence 10.4%)

		P	OR	95% C.I.	
				Lower	Upper
Sample source	detoxification center vs. community	0.095	0.09	0.01	1.53
Gender	female vs. male	0.019	7.44	1.40	39.57
Age	<30 vs. >30	0.131	2.19	0.79	6.02
Marital status	live with partner vs. live alone	0.038	2.51	1.05	6.00
Education	$\leq 9$ years vs. $>9$ years	0.030	3.06	1.12	8.39
IDU	yes vs. no	0.323	1.73	0.58	5.10
STD symptoms in last 12 months	yes vs. no	0.601	0.61	0.10	3.91

# Chapter IV

## DISCUSSION

*“In a world that is divided along many lines, we now have a unique opportunity to bring us all together around a common challenge in ensuring that the millions of people who are infected and affected by HIV and Aids are not forgotten, we will not only make a difference to their lives, we will also make a difference to our lives as well. We owe this at least to humanity.”*

--- Nelson Mandela,  
*(former President of South Africa, The Nobel Peace Prize 1993)*



#### 4.1 HIV/AIDS Among Drug Users in China

HIV/AIDS second generation surveillance is an annual routine work in China; target population groups include DU, FSW, STD clients, MSM, long distance truck drivers and young students. Cross-sectional survey is conducted with standardized questionnaire, it helps to trace the behaviour change over time, to describe the HIV/AIDS epidemic, the selection of sentinel sites is adjusted according to the national and local current situation of HIV epidemic (*China CDC, 2006*). After more than 20 years since the first HIV case was diagnosed in China in 1985, IDU is still the major mode of HIV transmission in China, though HIV transmission through heterosexual transmission is increasing (*China CDC, 2003, 2004, 2005*).

Worldwide, injecting drug use plays a role of HIV/AIDS transmission. HIV transmission among IDUs has always been a serious problem in America because of the risks posed by sharing injecting equipment. A study in 1988 found that one in four persons with AIDS in the United States had injected illicit drugs (*NIDA, 1988*). 21.5% of adult HIV diagnoses in 2003 and 26% of cumulative infections through 2004 were in people who had probably been infected by sharing needles or by being the sexual partner of an IDU (*CDC, 2004*). In 2004, some 34% of women and 21% of men who were diagnosed with HIV were injecting drug users (*CDC, 2004*). Over 70% of all HIV cases in Russia occur in IDUs, WHO estimates that between 1.5 and 3.5 million Russians are IDUs, and the prevalence of HIV in the drug-using population reaches 65% in some Russian cities (*WHO, 2005*). In west Europe, the prevalence of HIV infection in IDU was 16% in France, and 31% in Spain in 1999 (*Semaille, 2003*). 89% of all HIV/AIDS cases are found in IDU in Tajikistan. It is estimated that up to 1% of the population of countries in former Soviet Union is injecting drug users, placing these people and their sexual partners at high risk of HIV infection. Outbreaks of IDU-related HIV/AIDS infection are already being reported in several Central Asian republics, including Kyrgyzstan, Tajikistan and Uzbekistan (*WHO, 2005*).

IDU is the major mode of HIV-1 transmission in China, the HIV/AIDS second generation surveillance among drug users in 2005 showed HIV-1 antibody prevalence was 5.0%, HIV-1 antibody prevalence was 6.6% among IDU, and prevalence of positive syphilis antibody status (active or former syphilis) was 2.8%. In several sentinel sites no HIV cases were recorded, whereas in others the prevalence was as high as 21.0% in Guangxi Nanning, 10.8% in Xinjiang Kashi, and 29.4% in Sichuan Liangshan. A site in Yunnan province was excluded because lack of key information of risk behaviour in this study, however, HIV-1 prevalence was 54% (54/100) in this site. The sites with higher HIV prevalence all located in west and south-west regions along the drug trafficking route. The risk of HIV infection was associated predominantly with minority status, lower education, and injecting drug use/sharing needles.

Risk behaviours among drug users in China are mainly due to injecting drug and needle-sharing, and unprotected sex among drug users and their partners (*Zheng et al, 1994*). Injection drug use is the primary mode of transmission of HIV transmission in China. The cumulative number of reported HIV positive cases from 1985 to 2004 was 89,067, in which IDUs accounted for 41% (*MOH, China/WHO, 2004*). By the end of 2002, HIV positive has been found among drug users in all mainland 31 provinces, autonomous regions and municipalities (*UNAIDS, 2004*). By the end of 2005, there were approximately 650,000 people living with HIV/AIDS in China; in which 288,000 were drug users living with HIV/AIDS, accounting for 44.3% of the total number of estimated HIV cases (*MOH, 2006*).

The epidemic is characterized by a wide disparity between high and low prevalence regions. The prevalence rate among IDUs is quite higher in the south-western and north-western areas which border Laos, Myanmar, and Afghanistan; in some regions of Xinjiang, Yunnan and Sichuan even over 50% (*MOH, China/WHO, 2004*). The major mode of HIV infection in the above four provinces with the highest reported cases of HIV/AIDS, including Yunnan, Xinjiang, Guangxi and Sichuan, is attributed to injecting drug use (*MOH, China/WHO, 2004 & China CDC, 2003*). In these regions, the proportion of minority population is much more higher than overall

8.4% minority of the entire population (*Xiao, et al, 2007*), 30% of reported HIV/AIDS cases were from ethnic minority group (*Deng et al, 2007*).

In this study, the sentinel sites which the HIV-1 prevalence was over 5% in abovementioned higher prevalence regions were Guangxi Nanning 21.0%, Xinjiang Kashi 10.8%, Sichuan Liangshan 29.4%, respectively; definitely higher than other drug user sentinel sites; based on logistic regression analysis, demographic and behavioral factors that significantly associated with HIV prevalence were shown below: minority versus Han-Chinese (OR 4.10; 95% CI 3.03-5.55;  $p < 0.001$ ), education  $\leq 9$  years versus  $> 9$  years (OR 1.61; 95% CI 1.20-2.15;  $p = 0.001$ ), profession white collar versus blue collar (OR 1.69; 95% CI 1.25-2.27;  $p = 0.001$ ), injecting drugs without needle-sharing versus not injecting (OR 2.49; 95% CI 1.77-3.52;  $p < 0.001$ ), injecting drugs with needle-sharing versus not injecting (OR 4.44; 95% CI 3.19-6.19;  $p < 0.001$ ). The rate of needle sharing among IDUs may indirectly affect or reflect the HIV infection rates and trends of HIV prevalence among IDUs.

Yunnan is the HIV/AIDS hardest hit province in China, more epidemiological and molecular studies have conducted in Yunnan to trace the epidemic, Yunnan suffered first HIV epidemic in China, and accounted the biggest number of HIV infections in China (*China CDC, 2003*). In 2004, the HIV-1 prevalence among IDUs in Yunnan was between 21.2%-27.8%, in some IDU groups, the HIV-1 prevalence was even over 80% (*Lu et al, 2004*). By the end of 2004, Yunnan had cumulatively reported 28,391 HIV infections (*MOH, China/WHO; 2004*). Zhang et al. studied HIV-1 patients in Yunnan using immunoassays found HIV-1 subtype C/CRF07\_BC/CRF08\_BC and CRF01\_AE were codominant among IDU, the discovery of many sexually transmitted CRF01\_AE cases was new and suggested that HIV-1 could be transmitted through “bridge population” into general population, this subtype may lead to a new epidemic in the general Chinese population (*Zhang et al., 2006*). Yu et al. found unprotected sex continued to occur at high rates among IDUs and their sex partners in Yunnan (*Yu et al., 2003*). The same phenomena also found in another HIV-1 molecular epidemiological study by Zhang et al. in 2004 in Xinjiang found HIV-1 infected by homo- or heterosexual

transmission multiple subtypes of HIV-1 which were related to strains dominated among IDUs suggested HIV-1 has spread into general population (*Zhang et al., 2004*).

High prevalence of HIV-1 among IDUs found by Zhang et al in a cohort study was 71.9% (174/242), needle/syringe sharing was the major risk factor, most HIV-1 infected IDUs were unemployed, single, aged 20-35 years, and Han-Chinese; all three sites from Yunnan (Gejiu, Kaiyuan and Yanshan) located along the drug trafficking route (*Zhang et al, 2002*). The National Narcotic Control Commission also reported in 2002 that the majority of drug users were young people with a low education level and limited job skills (*NNCC, 2002*). Liu et al conducted a cohort HIV-1 sero-incidence study among drug users in rural Guangxi found baseline HIV-1 antibody prevalence was 25% (172/702), and risk factors were elder male drug users who injected drug and shared rinse water (*Liu et al., 2006-b*). Li et al found HIV prevalence among IDUs was 17.8% (56/314) in southern Sichuan, it was significantly associated with minority status and frequently needle-sharing (*Yin et al, 2007*). A community-based study among IDUs in Sichuan conducted by Choi et al found HIV risk behaviour was significantly associated with younger age and less family support for male IDUs; and for female IDUs, it was significantly associated with having an IDU sex partner and economic pressure; the probability of condom use by female IDUs who engaged in commercial sex was low (*Choi et al, 2006*).

In this study, based on logistic regression analysis, no demographic and behavioral factors significantly associated with HIV-1 prevalence in Guangxi Nanning; demographic and behavioral factors significantly associated with HIV prevalence in Sichuan Liangshan were: minority versus Han-Chinese (OR 9.96; 95% CI 1.24-80.26;  $p<0.05$ ), IDU versus Non-IDU (OR 1.94; 95% CI 1.21-3.11;  $p<0.01$ ); demographic and behavioral factors significantly associated with HIV prevalence in Xinjiang Kashi were: female versus male (OR 6.34; 95% CI 1.30-30.82;  $p<0.05$ ), age  $<30$  versus  $>30$  (OR 5.71; 95% CI 1.50-21.70;  $p<0.05$ ), live with partner versus live alone (OR 2.97; 95% CI 1.17-7.53;  $p<0.05$ ), IDU versus Non-IDU (OR 6.25; 95% CI 2.46-15.87;  $p<0.001$ ), have had commercial sex in last 12 months versus no

commercial sex in last 12 months (OR 5.08; 95% CI 1.06-24.46;  $p < 0.05$ ). The findings in this study are also coincident with results from other studies, Injecting drug is the leading risk factor among drug users, and most drug users are young male minorities with lower education and lower socio-economical class, the proportion of female drug users who engaged in commercial sex is higher; at the same time, HIV infection among Han-Chinese drug users increases; all these factors speed the HIV transmission between the higher risk population groups and from the higher risk population groups to the general population.

A molecular study by Piyasirisilp et al in 2000 discovered that some subtypes BC and CRF of HIV-1 dominated among IDUs in Yunnan have spread through drug trafficking to the neighbouring provinces of Guangxi and to the west province of Xinjiang (Piyasirisilp et al, 2000). Co-circulating of multiple subtypes of HIV-1 in China implies the possibility of interclade recombination. Beryer et al also found HIV-1 subtypes B, C, and a B/C recombinant subtype spread from Yunnan to north and west, to Xinjiang (Beryer et al, 2000). The close relationship between viruses found in Yunnan, Guangxi and Xinjiang strongly showed HIV-1 epidemic among IDUs in China is likely to have a common origin. A study in Xinjiang showed HIV prevalence among drug users was 24.5%, and among IDUs was significantly higher (56.1%) (Ni et al, 2006). Zhang et al. found in a cohort study in Xinjiang baseline HIV-1 prevalence among high-risk IDUs was 29% (228/781), HIV infection among IDUs in Xinjiang spread rapidly (Zhang et al., 2007). HIV-1 has already spread far beyond the south border provinces of Yunnan and Guangxi into the distant northwest province of Xinjiang and neighboring province of Sichuan. These studies approved the hypothesis that the HIV-1 virus disseminated widely into many other provinces and population groups in China originated in Yunnan (See Figure 4.1). There are also several cohort studies tried to identify the HIV incidence among IDUs. HIV incidence density during 12-month follow-up period found in these studies was more than 2 per 100 person-years among IDUs, and the incidence density rose with the follow-up (Zheng et al, 1994; Lai et al, 2001; Ruan et al, 2005). Like HIV prevalence studies among drug users, these results also demonstrate that HIV is spreading rapidly among IDUs.



Figure 4.1 HIV transmission among drug users in China

*Source: China CDC, MOH*

HIV/AIDS second generation surveillance is a cross-sectional survey. In order to guarantee the representativeness and avoid the potential arrest of the samples' illegal behaviours in China, anonymity and confidentiality are assured among drug users surveyed in second generation surveillance (*China CDC, 2006*). Aside from recall bias, this study had several limitations. A site in Yunnan province was excluded because lack of key information of risk behaviour, HIV-1 sero-prevalence was 54% (54/100) in this site. Some studies have found drug users were more likely to engage in high-risk sexual behaviors, and most female drug users engaged in commercial sex (*Zhang et al., 2002; Lau et al, 2005; Yang et al., 2005; Qian et al., 2005; Tucker et al., 2005; Chu & Levy, 2005*). A number of studies suggested that HIV infection spread from high risk groups into the general population mainly due to sexual transmission (*Zhang et al., 1999; Zhang et al., 2001; Huang et al., 2004;*

*MOH, China/WHO, 2004; Hesketh et al., 2005; Zhu et al., 2005, Shao, 2006; Lonn et al, 2007).*

The prevalence of HIV infection in this study could underrepresented the current situation among drug users in China. The number of female drug users in this study was relatively low (15.2%). With such a lower proportion of female drug users and no answer of key questions, analysis that evaluated the association between HIV positive and risk behaviours among female drug users could not be given. Therefore, any conclusions regarding female-related risk behaviours, based on the results in this study, should be cautious.

A particular tragedy of the AIDS epidemic is that the spread of HIV goes largely undetected until it has already disseminated widely in vulnerable populations. In the absence of effective ART, full-blown AIDS generally occurs 9 to 10 years after new HIV infection. Early surveillance systems, based on case reporting of persons presenting with symptoms of HIV-1 infection or AIDS to hospitals and clinics, are very helpful, thus, even second generation surveillance provides more useful information to trace the HIV epidemic and risk behaviour changing, HIV/AIDS reporting is still a useful tool to supply more useful information.

## **4.2 HIV Transmission Through “Bridge Population” from Drug Users to General Population**

A bridge that can transmit the HIV virus from IDUs to non drug user population is risk sexual activity (*Rhodes & Malotte, 1996*). A majority of IDUs in China are young heterosexual men. These men have the potential to transmit HIV virus to their sexual partners: commercial sex workers, girl friends, wives, etc., many who do not have the awareness of condom use (*Tucker et al, 2005*). Male drug users have the characters of multiple heterosexual partners and low condom use rate in comparison to male who do not use drug. In addition, commercial sex work is on the rise in numerous Chinese cities since economic reform launched in China, and the overlap between injecting drug use and commercial sex is high, i.e. a big part of female IDUs practice commercial sex work, and many of them do so in order to get drugs; a big part of male IDUs pay for sex (*CDC, 2001*).

HIV transmission from sex workers to their clients is quite common, and these IDU male clients may subsequently infect their non-IDU sex partners. Unprotected sexual behavior among IDUs and their sex partners may create “bridge population” from high to low risk populations (*Klee, 1996*). The mobility and changing behavior of male bridge population could accelerate HIV infection from higher risk groups to general population through heterosexual contact. Thus, IDUs and sex workers act as a bridge for sexual HIV transmission between IDUs and non-IDUs in China, speeding a more widespread epidemic, while HIV and STD prevalence are more traditional metrics for the heterosexual spread of HIV. “Bridge population” is worthy of further consideration to predict transition from a concentrated epidemic to generalized one. See Figure 4.2



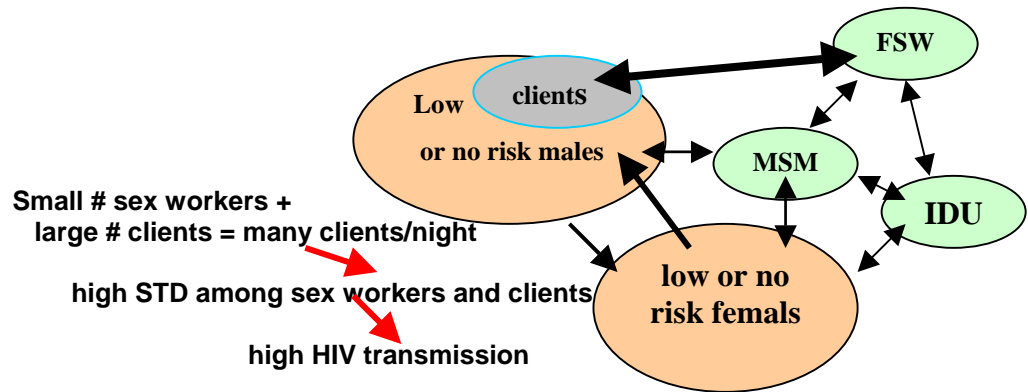


Figure 4.2 Risk behaviours and the potential for HIV spread in China  
 Source: China CDC, MOH

A cohort study showed that HIV prevalence among spouses of HIV infected persons increased from 3.1% in 1990 to 12.3% in 1997. In 1998, the HIV infection rate was 0.3 percent. In 1999, it went up to 1.1 percent (*MOH, 2000-a*). A molecular study showed IDUs and their sexual partners in Kunming Yunnan, Nanning Guangxi, and Yining and Urumqi in Xinjiang carry HIV-1 CRF07 and CRF08 subtypes, it demonstrated these strains of HIV-1 have spread into the general population (*Zhang et al, 2004*). In 2006, Zhang et al conducted a large scale prefecture by prefecture HIV-1 infection molecular study in Yunnan, HIV-1 subtypes C/CRF07\_BC/CRF08\_BC and CRF01\_AE predominate in Yunnan, accounting for 53% and 40.5% of HIV-1 infections, respectively. Because 85.4% of CRF01\_AE infections were acquired through sexual contact, while 90.9% of IDUs had C/CRF07\_BC/CRF08\_BC viruses (*Zhang et al, 2006*); IDUs still are dominant of HIV infection, there is an increasing proportion of HIV-1 infections through sexual transmission.

HIV infection among Han-Chinese has increased more quickly than among ethnic minorities recently; the infection among rural-to-urban migrant workers is also increasing that speeds the HIV spread from rural to urban areas; and in some areas

in Yunnan, HIV prevalence among pregnant women also increased; all factors show that HIV transmission through heterosexual contact is increasing, and HIV infection is spreading from higher risk population groups to general population (*Liao et al, 1997; Hesketh et al, 2005; Zhang et al, 2006*).

Sexual risk behaviours may contribute to the HIV infection among female IDUs. IDU dominated HIV epidemic in the late 1980s and throughout the 1990s has been gradually replaced by those infected through heterosexual contact or other routes in Yunnan; in Dehong county, Yunnan province, HIV prevalence was over 1% in pregnant woman, HIV epidemic in Yunnan is already in a generalised phase (*Cohen, 2004*). STD clients and female sex workers are the two major components. Result of a surveillance survey among drug users in Xinjiang showed only 19.2% drug users used condom by latest sex with their sex partners (*Xinjiang CDC, 2005*). In this study, risk factors significantly associated with syphilis status in Xinjiang Kashi were female drug users who lived with partner with lower education, risk factors significantly associated with syphilis status in Guangdong Dongguan were lower educated female injecting drug users who lived with partner, female drug users were also a risk factor for syphilis infection in Guangxi Nanning; further research should also investigate the partner's drug use behaviour (See Chapter III); it also indicated female IDUs who engaged in commercial sex could spread the HIV-1 virus transmission into general population.

Yang et al carried a systematic review of behavioural studies about heterosexual transmission of HIV in China in 2005, they found circa 30%-75% drug users have had multiple sexual partner, condom use rate was low; the number of female drug users was rising, and most of them (52-98%) engaged in commercial sex (*Yang et al, 2005*). A community-based study among IDUs in Sichuan conducted by Choi et al found HIV risk behaviour was significantly associated with younger age and less family support for male IDUs; and for female IDUs, it was significantly associated with having an IDU sex partner and economic pressure; the probability of condom use by female IDUs who engaged in commercial sex was low (*Choi et al, 2006*). Female drug users who engaged in commercial sex to support their drug use may

have no sufficient power to insist on condom use of their clients (*Ferry & Anderson, 1992; Huang et al., 2004*). All these factors indicate HIV infection could be transmitted easily from higher risk population to general population. Not only drug users who have connection with general population form the bridge, female sex workers, young migrant population and MSM who also engaged in heterosexual intercourse are also components fuelling the epidemic to accelerate the transmission from high risk group to general population.

In this study, factors significantly associated with syphilis infection were female IDUs with lower education and minority status. Lin et al in 2006 reviewed systematically sero-prevalence studies related to China's syphilis epidemic and found syphilis infection is increasing not only among higher risk groups but also among low risk groups, it suggested unprotected sex intercourse could accelerate HIV transmission from higher risk groups to general population (*Lin et al, 2006*). A cross sectional study on female sex workers conducted by Yuan et al in Xichang, Sichuan showed high syphilis prevalence was dominated among FSWs along a drug trafficking route who engaged in unprotected sex and injected drug; it indicated a potential rapid HIV transmission from injecting female sex workers to general population; urgent intervention should be issued to break the bridge (*Ruan et al, 2006*). Another sero prevalence survey on female sex workers in Yunnan found 9.5% syphilis positive and HIV prevalence was 10% (52/505), and all HIV positives were IDUs (*Chen et al, 2005*). Most FSWs were at young age with lower education and high mobility and low condom use rate, all these factors would fuel the HIV epidemic spread from high risk population to general population (*Lau et al., 2002; Chen et al, 2005*). Huang et al conducted a study focused on HIV knowledge among female sex workers and addressed HIV prevention strategy must consider the socio-cultural aspect to promote the condom use and safe sex (*Huang et al, 2004*).

The government must increase support for safe needle exchange programs to reduce the spread of HIV among the IDU population, at the same time, the government needs also to put more focus on drug prevention programs. Future HIV prevention strategies targeting IDUs should include sexual risk reduction to reduce the potential

spread between the IDUs and non-IDU populations and promote condom use. Besides traditional STD/HIV prevention services, targeting high risk sex workers and clients is of great value to make prevention activities success. With such alarmingly high rates of HIV infection among the IDUs and syphilis infection among female sex workers, this problem cannot be ignored; and the control of the sexual transmission of HIV in China will have a significant impact on the war against HIV epidemic, especially with a extensive mobile population and disproportioned male female ratio in China.

### 4.3 Intervention Strategy on Drug Users in China

As of today, there is still no cure or vaccination against HIV/AIDS, and HIV virus transmission is highly related to individual behavior, such as, injecting drug/sharing needles, MSM, unprotected sex; so that behavioral intervention becomes an effective and efficient approach to prevent HIV/AIDS transmission. Working specifically with IDUs can help to reduce their risk of infection of HIV. As we know, the most risk behaviors among IDUs are injecting drug and sharing inject equipments, i.e. syringe, cotton, and rinse water, it means the intervention programmes among IDUs should concentrate on harm reduction behavior, that is abandon injecting behavior or use cleaning apparatus.

Drug use is illegal in China. All identified drug users will be registered by Public Security Bureau (NNCC, 2002). The Chinese government typically takes "crackdown" actions and tries to remove this behaviour. Now, the Chinese government actively seeks to collaborate with neighbouring countries to prevent drug smuggling across borders. Chinese mass media have increased anti-drug education to the general population. School's curricula also cover the anti-drug education. Methadone maintenance therapy is the main action that Chinese government taking for drug users to abandon their risk behaviour, The National Working Group for Community based Methadone Maintenance Therapy was established collectively by the Ministry of Health, the Ministry of Public Security, and the State Food and Drug Administration Guidelines for methadone maintenance therapy and needle exchange programs were enacted in early 2004 (MOH, 2004a).

Methadone, a synthesized narcotic which is far less noxious than heroin, is widely used internationally as a substitute drug to help drug users to abandon their addiction. By the end of 2004, there were 34 methadone maintenance therapy clinics and 90 clean needle exchange service points across the country (Qian et al, 2006). To the middle of 2006, over 300 methadone maintenance therapy clinics were established and covered 21 provinces (China CDC, 2006). By the end of 2006, the total number of methadone maintenance treatment clinics reached 320, the average

capacity of each clinic was 200 patients per day (*Gill & Okie, 2007*). However, methadone maintenance therapy is a long-term therapy. The most drug users who stop methadone maintenance therapy will reuse drug.

If IDUs are provided with information and clean injecting syringes/needles then they can be promoted to take action to prevent HIV infection. IDU-related HIV transmission can be greatly reduced by the provision of clean needles, so called 'needle exchange'. Needle exchange programmes specifically address the high risk behaviour of IDUs - sharing needles. This strategy is therefore referred to as 'harm reduction', since it does not attempt to prevent or stop their drug use behavior, merely reduce the harm –risk behavior it causes them. Because it does not try to break the dependence on drugs that most drug users have, this strategy is usually far more successful at preventing HIV transmission. After a long time of HIV/AIDS campaign in the world, today, most IDUs know the risks of sharing injecting equipment that transmit HIV virus, and do not do so through choice, but through a lack of alternatives. When they are able to access clean equipment, they would do so.

In China, cleaning needle is easy accessible in urban areas because it is sole legally in all licensed pharmacies and clinics. However, most drug users in China live in rural areas and most of them can not afford the price of frequent use of cleaning needles. Needle exchange program offers drug users an opportunity that they can get cleaning needles for free or in a low affordable price. Needle exchange schemes have been shown by a number of studies than significantly reduced HIV transmission amongst IDUs. In 2006, 12 provinces in east and south China that have severe drug problems have established around 100 needle exchange centres. Needle exchange, together with community outreach work to IDUs, has caused a decrease in heroin use and drug-related crimes among participants. By the end of 2006, over 10,000 drug users in Guangxi joined the needle exchange programmes, the needle exchange programmes also launched in other provinces that HIV epidemic dominated by IDUs, such as Yunnan, Xinjiang, and Sichuan (*China CDC, 2006a*). Li et al reported 20% of all drug users in Liuzhou have received harm reduction service (*Li et al., 2007*). At the same time, program has also launched in rural areas where public

health infrastructure is not well-developed; other additional services, like condom distribution, VCT, ARV therapy, and drug user education are offered to drug users, too (*Liu, 2006*).

This study provides useful information with respect to the HIV-1 prevalence, risk behaviours and demographic characteristics associated with HIV infection among drug users in China. Since the emergence of epidemic, China has launched HIV prevention and harm reduction program. A comprehensive program to prevent the further transmission of HIV among drug users has been implemented that includes community based harm reduction programmes, mainly methadone maintenance treatment and needle-syringe programme.

In 2003, China announced a national AIDS control policy, “Four Frees and One Care” (free treatment, free Voluntary Counselling and Testing (VCT), free Prevention of Mother to Child Transmission (PMCT) and free schooling for AIDS orphans, and provision of social relief for HIV patients) (*MOH, China/WHO, 2004*). Large-scale intensive education programmes should also be conducted in all drug detoxification centres. Efforts should include a series of activities: safe sex education, AIDS counselling, harm reduction, and treatment of HIV infected (*Zhang et al., 1999*). There are some aspects must be still considered, drug users who enrolled in methadone treatment or needle exchange programs only accounted a small proportion of the whole population group, the follow-up or after-care of drug users who go through detoxification center should be strengthened (*Liu et al., 2006*). These efforts are likely to require an infrastructure that not only provides operational and financial support, but also creates an environment in which drug users feel comfortable and safe in seeking help and non-discrimination.

#### **4.4 Use of Surveillance Data**

Surveillance data with good quality could be used to improve HIV/AIDS campaign program, to assess the effectiveness of prevention, to provide convictive evidence for policy maker, and generate response from the whole society and affected community. According to the guidelines for effective use of data from HIV surveillance systems by UNAIDS, surveillance data could be used in three main areas: programme planning, programme monitoring and evaluation, and advocacy (*UNAIDS/WHO, 2004*).

Since HIV/AIDS first emerged in China in 1985, Chinese HIV/AIDS surveillance system has improved from passive surveillance to active surveillance, the system is getting more mature and well-organized. Based on high quality data, effective and efficient prevention and intervention strategies have been conducting through the country. Besides second generation surveillance data, there are multiple data sources available in China now, it includes case reporting data, sentinel surveillance data, STI surveillance data, vital statistics, and data from prevention of MTCT and VCT and antiretroviral treatment (*China CDC, 2006*). A number of epidemiological studies funded by NGOs or international organizations also provide useful information. All these data could be integrated to understand the HIV epidemic dynamics, to make right decision on AIDS policy and intervention.

surveillance report is published annually in China. The report covers not only the information about surveillance methodology, surveillance site selection, participants selection protocol, the types of test used, quality control procedure, sample size and results; but also about behavioural information (*China CDC, 2005*). As an official data source, it could be used as an effective communication means with other government organisations, the media society, donor organisations and other interested blocs (*Pervilhac et al, 2005*), it provides convictive data to evaluate the implementation of prevention and intervention activities.



Surveillance data could be used in different level in a country, at the national level, the magnitude of the epidemic and its distribution in different geographical areas and subpopulations could be assessed with the help of national surveillance data; at the regional and local level, surveillance data could be used to identify affected areas, to seek solutions and to design strategies appropriately to the varying epidemic. Epidemiological survey in 2003 showed HIV prevalence among former commercial plasma donors was 2.7%, most cases (40%) were in Henan province (*MOH, 2004*); by the end of 2005, it is estimated circa 69,000 infections in this group, accounting for 10.7% of the total number of estimated HIV cases. Henan, the center of HIV epidemic among former commercial plasma donors, with Hubei, Anhui, Hebei, and Shanxi provinces, accounted for 80.4% of infections in this group (*MOH, 2006*). Based on data collected through sentinel surveillance and other epidemiological studies, a national screening program was conducted in China, it suggested that the epidemic has been more localized among this group (*Wu et al, 2001*), all illegal blood collection sites were closed, and Chinese government enacted blood regulation law to ban any kind of illegal blood collection. AIDS care and treatment program have launched since then.

HIV/AIDS surveillance data is also a very important data source for estimating the number of people living with HIV/AIDS in a country, to assess the HIV/AIDS burden, to allocate the prevention resource and to plan the care and treatment. HIV sentinel surveillance data primarily are used to calculate HIV prevalence with help of other epidemiological studies, such as epidemiological surveys, and surveys among former commercial blood and plasma donors and other key population groups. The number of people living with HIV/AIDS is estimated biennially according to UNAIDS. In 2005, it was estimated 650,000 HIV cases in China. There were approximately 288,000 drug users living with HIV/AIDS, accounting for 44.3% of the total number of estimated HIV cases. Seven provinces – Yunnan, Xinjiang, Guangxi, Guangdong, Guizhou, Sichuan, and Hunan – each have had more than 10,000 drug users infected with HIV, and these 7 provinces accounted for 89.5% of the HIV/AIDS cases among drug users (*MOH, 2006*).

Surveillance system and surveillance data trace the HIV/AIDS epidemic, provide useful information for Chinese government and policy maker. Especially, second generation surveillance is an on-going cross-sectional survey, it combines HIV surveillance, STI surveillance, and behavioural surveillance. Before surveillance data are collected, investigator should have some idea of how they will be used in planning and evaluating programmes or in advocacy. For drug users, the risks of HIV virus transmission are sharing injecting equipment and unprotected sex (*Zheng et al, 1998*). When the surveillance conducts repeatedly, and supplies with other useful information, such as ethnographic and qualitative research, geographical information; epidemic trend could be projected from abovementioned data source (*UNAIDS, 2004*). Additionally, the data could give a living picture of behaviour changing, it is not only very useful to estimate the size of at-risk population, but also for implementing effective and efficient prevention and intervention programs, such as, cleaning needle program for IDUs, methadone maintenance treatment for drug users, and condom promotion program. It is still a challenge to understand well HIV/AIDS epidemic from limited data source (*Foulkes, 1998; Raab & Parpia, 2001*).

## 4.5 Limitation of HIV Surveillance and Limitation of This Study

### Quality of surveillance system

Second generation HIV/AIDS surveillance was developed by UNAIDS based on first generation HIV/AIDS surveillance that only concentrated on HIV sero-prevalence, it combines HIV sero-prevalence surveillance, STI surveillance, and behavioral surveillance (*UNAIDS/WHO, 2000*). HIV infection is definitely related with higher risk behaviour, for example, unprotected homosexual contact between gay, unprotected heterosexual contact, sharing contaminated injecting equipment among IDUs; thus, to know the risk behaviour among higher risk population groups and behaviour changing among them will help policy maker and public health officers to implement effective and efficient prevention and intervention strategy, to trace the epidemic more accurately; so that the quality of HIV/AIDS surveillance system is of great importance.

Since 1999, China launched HIV/AIDS second generation surveillance based on the guideline from UNAIDS, HIV/AIDS second surveillance is a routine work in China in a yearly round, it includes following population groups: drug users, FSWs, STD clients, MSM, long distance truck drivers and young students (*China CDC, 2003*). The goal of the HIV/AIDS second surveillance is to provide a comprehensive picture of the HIV/AIDS epidemic in order to support prevention intervention strategy; NCAIDS is responsible for the collection, analysis, and interpretation of surveillance data.

The UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance has developed coding schemes to represent four dimensions related to the quality of surveillance systems: “

- Frequency and timeliness of data collection;
- Appropriateness of populations under surveillance;
- Consistency of the sites/locations and groups measured over time; and
- Coverage/representativeness of the groups for the adult populations” (*Garcia-Calleja et al, 2004*).

The coding schemes depend on the level of the HIV epidemic in a country. The levels are defined as generalized, concentrated and low. Generalized epidemic of HIV/AIDS means HIV prevalence is over 1% among antenatal clinic attendees, concentrated epidemic of HIV/AIDS means HIV prevalence is below 1% among pregnant women but over 5% among populations with high risk behaviours, for example, IDUs, female sex workers, MSM; low epidemic of HIV/AIDS means HIV prevalence is below 5% among populations with high risk behaviour. As a whole, China is a low epidemic country, HIV prevalence is lower than 0.1% (*China CDC, 2005*), however, China is the most populous country and third large country in the world, China is a country with big geographical and socio-economical disparity. For the HIV/AIDS epidemic, if we consider China as a whole is a low epidemic country, the HIV epidemic in China would be underestimated, because the HIV epidemic is really pressing in some regions, for example, in Yunnan province, the hardest hit region in China, the HIV prevalence among pregnant woman is already over 1% in some part of Yunnan, the HIV prevalence among drug users in Yunnan, Xinjiang, Guangxi and Sichuan is also in a critical level, so that more attentions should be paid in this regions, and consideration should be taken China as a whole.

There are some principles that help to design the sentinel surveillance surveys:

- The sample should be representative of the target population. Representative samples are those samples who not recruited in the survey has an equal or known probability with samples who recruited in the survey. This is the primary challenge of cross-sectional surveys, and most cross-sectional survey could not guarantee the representativeness of sample.
- Persons in the sample should be only included once. It is another challenge in surveillance activities that ensures that samples are not included multiple times. This challenge could be greater when the anonymity and confidentiality are guaranteed for target samples whose behaviours are illegal or discriminated, such as drug users in this study.
- The time to complete the survey should be short. Ideally, a cross-sectional survey represents a single moment in time, estimating, for example, point

prevalence. If the sample is collected over too long a time period, temporal changes may misrepresent estimates.

Only with the surveillance sites in right places could identify the distribution and magnitude of the HIV/AIDS epidemic on drug users, i.e. drug users engaging in risk behaviour must be included in the surveillance system. The most sites selected in urban areas because of the accessibility and resource availability, it could overlook the situation in rural areas. The sample of population group is another key point to compare infection and behaviour over time especially in different geographical regions; for example, if data of drug users from two sites are compared, recruiting settings should be identical, i.e. both are from community or detoxification center, otherwise, the outcome might be misleading. Sample size also should be considerate. Based on the local condition, sample size could not always be guaranteed to reach the needed number, any conclusion from the data outcome should be cautious, for example, higher HIV prevalence among a small sample size of drug users is unlikely to reflect the real situation, confidence interval of the prevalence should always be paid attention to see how reliable the outcome is.

The main aim of surveillance is to track trends over time. This is only possible when surveillance data is comparable between periodical rounds, thus, surveillance sites must be maintained over time. Trend data should only present data from sites used continually over the time period. The test method of HIV should also be identical. All investigated questions should be clearly definite before conduct survey, for example, if one wanted to look forward at the potential spread of HIV among drug users at young age, a core indicator would be the proportion who are injecting drug users and sharing needles, and the proportion with risk sex behaviours. But does “injecting” mean “ever injected” or “currently injecting”? How current is current? At what age counts man as “young”? What counts as risk sex behaviours? Are these who pay for sex or whatever unprotected sex? Were these distinctions clear to the subjects? All equivocal questions must be explained before survey in order to minimize the misunderstanding.

Drug users are normally marginalized and discriminated in the society, random samples of drug users are hard to obtain in most time, making comparisons across time questionable. Even with good internal consistency, the validity of self-reported data on drug use behaviour and sexual behaviour is frequently on doubt. Any conclusions about small rises or falls in infection, and surprising findings in behavioural surveillance should be cautious and investigated further. Data limitation should be aware, and in HIV/AIDS surveillance, data do not need to be perfect; but they do need to be good enough to provide a reliable evidence of the major trends in HIV infection and related risk behaviour.

In order to guarantee the quality of surveillance, all investigators who conduct interview were trained before the survey, they should be familiar with the questionnaire and command some interview skills in order to get more accurate information. They should respect target samples, be neutral, and non-prejudice. Investigators should also have ability to deal with any accidental situations and avoid any conflicts with subjects, after survey, questionnaire should be carefully rechecked and corrected if there are any missing values and mistakes, even so, it is inevitable that subjects reject to answer some sensitive questions or could not remember accurately what happened in the past.

China has established an effective and good organized surveillance system in many of most hard-hit south-western and western regions (*MOH, 2006*), however, surveillance system in low prevalence provinces is less comprehensive, and less information collected related to general population trends. Integrated social, economic, and behavioral research that helps planning the AIDS response is still premature (*Kaufman et al., 2006*). These data could be meaningfully used for understanding the role of individual risk behaviors and sexual networks for the potential transmission, and to understand the social and economic factors could determine these behaviors, such as poverty and social marginalization. Information related to access to care, health seeking, and health systems requirements is very helpful to design effective prevention and treatment strategy.

### **Representativeness of sample**

Regions that HIV/AIDS epidemic dominates by drug users locate along south-western and north-western areas which border Laos, Myanmar, and Afghanistan. This study also demonstrates that higher HIV/AIDS prevalence regions in abovementioned area. The issue of sample representativeness is decisive in cross sectional survey. Biases can arise when drug users selected in this study do not represent the general drug users in China, however, it is really difficult to reach the general representativeness among drug users in China which is the most populous country in the world and big geographical and socio-economical disparity between different regions.

The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. For example, it is proved by a number of studies that HIV/AIDS prevalence among drug users in Xinjiang is really higher (*Gill & Song, 2006*), however, in this study, one site in Xinjiang there was no HIV positive found. A study in Xinjiang showed HIV prevalence among drug users was 24.5%, and among IDUs was significantly higher (56.1%) (*Ni et al, 2006*). Zhang et al. found in a cohort study in Xinjiang baseline HIV-1 prevalence among high-risk IDUs was 29% (228/781) (*Zhang et al., 2007*). A site in Yunnan province was excluded because lack of key information of risk behaviour, HIV-1 sero-prevalence was 54% (54/100) in this site. Yunnan suffered first HIV epidemic in China, and accounted the biggest number of HIV infection in China.

The selection of sentinel sites should base on the local epidemic level, other useful data that obtained from HIV incidence studies, Cohort studies, or pilot studies conducted by other organisations could be used to guide the selection of sentinel sites, while sentinel surveillance only collect the HIV prevalence data, HIV incidence data could provide more useful information on current HIV new infection among selected populations and temporal changing of risk behaviours. In some hardest hit regions in China, for example, Yunnan, Guangxi, Xinjiang, and Sichuan, more sites could be selected according to the availability of local resource.

**Selection bias** is most important bias in surveillance. Selection bias can cause if the HIV-related behaviors in surveyed subjects are different from those who do not participate in the survey. Rejection to be surveyed among subjects is an important potential resource of selective bias. HIV-related behavioral surveillance usually involve in the subject's privacy or even the illegal behaviors, and the rejection-related bias can easily cause if the behaviors are different between subjects who reject survey and those who accept survey. Rejection bias may cause under-estimation of risk behaviors.

**Recall bias** means drug user who already test and know his HIV/AIDS status or who know his risk behaviour has a high probability to be infected with HIV virus might recall certain behaviors or 'exposures' different that other drug users, such as sharing needles, commercial sex.

China lacks the resources to carry out extensive surveillance in the countryside. Additionally, current surveillance protocols primarily cover only specific high risk groups. HIV-1 prevalence but not incidence was tracked in HIV/AIDS surveillance system, HIV-1 prevalence is defined as the proportion of persons who are infected with HIV-1 at a given point in time. In contrast, HIV-1 incidence is defined as the rate at which new HIV-1 infections occur in a population in a given period of time. The measures of HIV-1 prevalence and incidence have different uses in public health. While HIV-1 prevalence is a measure of the relative burden of disease in a population, HIV incidence indicates the extent to which transmission of the virus is occurring. HIV incidence can be used to understand the current spread of infection, appropriately target prevention resources to those most vulnerable to HIV, monitor and evaluate prevention efforts, identify masked or missed sub-epidemics, and closely track the emergence of new sub-epidemics of HIV in the general population.

Sample size needed in sentinel surveillance is 300-400, however, in this study only 10 sentinel sites reached the needed sample size (300-400), they were Gansu Wuwei, Guangdong Dongguan, Guizhou Qianxinan, Guizhou Tongren, Hebei



Shijiazhuang, Hubei Xiaogan, Hubei Jingzhou, Qinghai Haixi, Sichuan Liangshan, and Chongqing. The rest sentinel sites did not recruit the needed samples. The proportion of missing values of some key variables was quite higher, especially the variables related to the sexual behaviours, any conclusions regarding to sexual risk behaviours should be viewed with caution based on the outcome of this study. It should be paid attention for the henceforth surveillance to recruit enough samples, increase the quality of data and do best to decrease the missing values.

Other data sources (e.g. blood screening data, one-off studies) should be used to calibrate prevalence estimates. HIV case reports are mainly useful in the early stage of an epidemic or in low-level epidemics. Clearly defined national protocols for HIV testing and surveillance should be developed, taking into account ethical issues. Linked HIV testing requires informed consent and appropriate follow-up of HIV-positive cases. Particular attention should be paid to ensuring the continuous monitoring of trends of HIV prevalence in selected populations. HIV/AIDS reporting system should also integrate into existing communicable disease reporting systems to make use of available facility and human resources and therefore reduce cost.

Ideally, time changing of the number and distribution of HIV new infections reflects current epidemic, however, these data are hard to obtain under current surveillance system. Thus, epidemiologists have used HIV prevalence data from sentinel surveillance to monitor HIV infection (*Lu, 2004*). HIV sentinel surveillance data were analysed to calculate the prevalence of HIV by person, place and time; in which changes in HIV prevalence over time are of greatest value. Even though, over- or under-estimate the true prevalence of HIV may be caused by sentinel surveillance data because of the selection bias. If sentinel surveillance is conducted consistently year by year, the changes over time may reflect the real change of HIV prevalence.

#### **4.6 AIDS Policy in China**

AIDS prevention and AIDS policy are the core of the combat against HIV/AIDS epidemic, they tested government's ability to provide leadership in formulating an appropriate public response to the crisis.

China has banned all blood products from abroad in 1985 (*Xinhua Agency, 1985*). In May 1996, Red Cross and Red Crescent Societies of China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, the Philippines, Thailand and Vietnam met in Beijing to create a reproductive health and AIDS prevention manual (*Xinhua Agency, 1996*). This manual is the basis in training 10,000 young adults "who, in turn, will cascade key HIV/AIDS prevention messages to young people in China and the other participating countries. In addition to youth peer education, member countries will also focus particularly on strategies to reduce the spread of HIV/AIDS among women, who much rely on their partners to practice safe sex and are, therefore, increasingly vulnerable to the deadly virus. In December 1996, the State Council issued new regulations on China's blood supply (*DPA, 1996*). The new laws promote all Chinese between the ages of 18 and 55 should donate blood, and calls for stricter measures to protect the nation's blood supply. The new law would ban paid blood donations and punish blood dealers. China's first law regarding blood donation enacted in October 1998 (*China Daily, 1998*). The law "lays down the rights and duties of Chinese citizens relating to the donation and use of blood as well as standardizing the practices of blood collection and supply institutes".

In the war against HIV/AIDS, the establishment of China CDC AIDS/STD centre in 1998 is one of the most positive activities (*NCAIDS, 1998*), it directs the HIV/AIDS prevention programs at the national level and established the HIV/AIDS Control Centers in every province, it institutes national guideline of HIV/AIDS activities, provides technical support, develop HIV/AIDS test methods and vaccine, and co-operates with international organisations and other NGOs and interested parties. (The structure of China CDC, please see Figure 4.3)

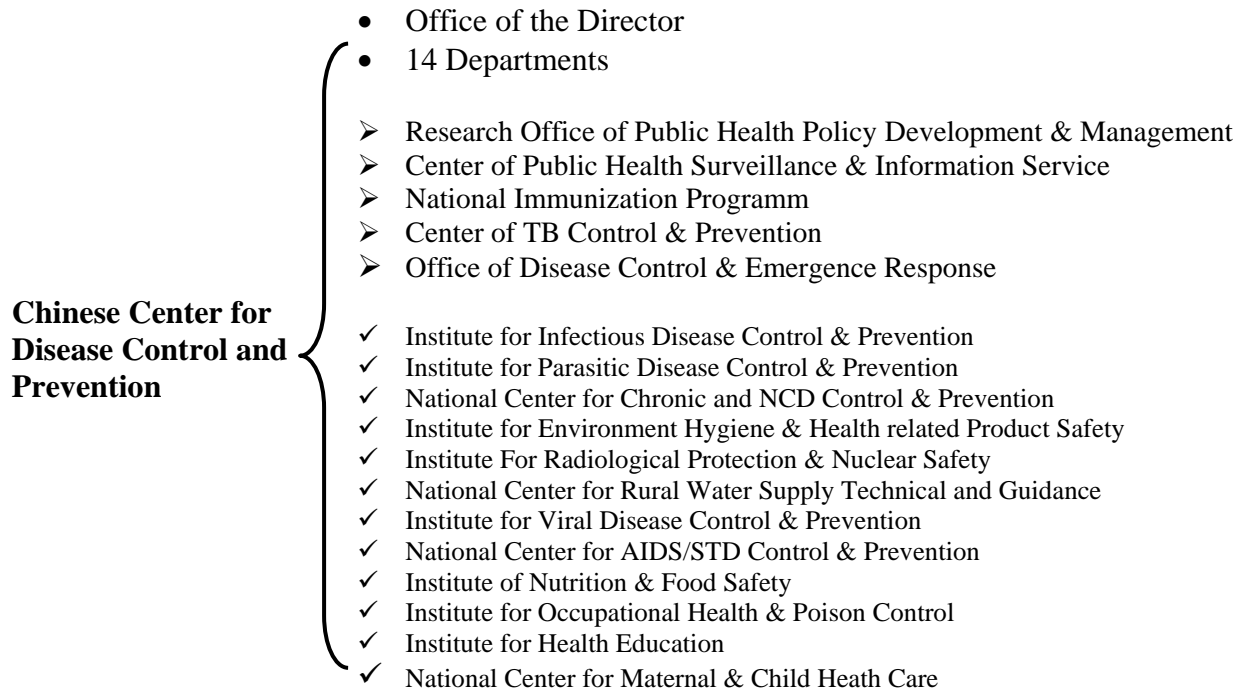


Figure 4.3 The Structure of Chinese Center for Disease Control and Prevention  
 Source: MOH, China; China CDC

On 12 November 1998, China officially released its Medium and Long-term Strategic Plan of AIDS Prevention and Control (1998-2010) by State Council (*State Council, 1998*). The plan aims to keep the number of China's HIV infections to under 1.5 million by the year 2010. This plan was formulated to promote timely HIV/AIDS prevention and control work by governments and sectors at all levels, to ensure that various strategies and measures are implemented, to enhance the capacity of all societies and communities to resist the disease, and to mitigate the impact of HIV/AIDS to the health of China's people and to China's socio-economic development, on the basis of both international and Chinese domestic experience. The general goals of this plan are: to establish a government-led system of HIV/AIDS and STDs prevention and control in which many sectors work together and the entire society participates, and to disseminate needed knowledge to the whole society for the prevention and control of HIV/AIDS and STDs.

In 1999, MOH announced a new regulation on the rights of patients who have been infected with HIV/AIDS (*MOH, 2001a*). The new regulation ensures the following rights for HIV/AIDS patients: the identity or address of any HIV/AIDS patient should keep confidentiality; medical personnel must keep the patient's medical information confidential, and all samples should be sent to authorized laboratory for confirmation; medical documents belonging to HIV/AIDS patients are considered confidential and are only to be handled by assigned personnel; all charged public health departments provide treatment for HIV/AIDS patients; no medical facility can refuse medical treatment to HIV/AIDS patients; HIV carriers and their children should keep their right to work, study or participate in social activities; HIV carriers are banned to donate blood, organs or other body fluids.

On June 25 2001, The MOH announced an updated China's Action Plan for Reducing and Preventing the Spread of HIV/AIDS (2001 - 2005) aimed at keeping HIV infections below 1.5 million by 2010 (*MOH, 2001-c*). According to the new plan, blood for clinical use would have to undergo complete HIV testing. To ensure the safety of the blood, more than 85 percent of blood for clinical use should be provided by non-profit blood centers, and the rest can be supplied by authorized hospitals for their own use. The plan also calls for the use of the media to promote tolerance and reduce discrimination and fear of HIV/AIDS victims.

In October 2002, China's State Council passed a resolution on improving healthcare in rural areas. The resolution aims to reach 90 percent of children in rural areas (to be) getting vaccination against common epidemic diseases by 2010. By then, 95 percent of rural counties should implement "modern measures" against tuberculosis by 2010; 75 percent of townships will offer HIV carriers and AIDS patients appropriate healthcare. The Chinese government has initiated a treatment program which will provide up to 100 counties AIDS medication (*MOH, 2003*).

On World AIDS 2003, Chinese Government announced an epoch-making AIDS policy: “Four Frees and One Care” policy (*MOH, 2004*), it stated for:

- Free ARV drugs for AIDS patients who live in rural areas or urban residents with low life standard;
- Free Voluntary Counselling and Testing (VCT);
- Free drugs to reduce or interrupt mother to child transmission of HIV (inclusive free testing of newborns);
- Free education for AIDS orphans;
- Care and financial assistance to the households of people living with HIV/AIDS.

This policy is a remarkable milestone of Chinese AIDS policy, it showed the Chinese government has tried his best to organize all sectors and the whole society in the fighting against HIV/AIDS, its influence is far beyond the HIV/AIDS field, it will also pose positive effect on current public health reform in China.

Free antiretroviral therapy has reached 20,453 AIDS patients in China by the end of 2005 (*Shao, 2006*). The new policy integrates prevention and treatment, with the massive propaganda and media coverage, people living with HIV/AIDS and people at risk are now voluntarily seeking testing, they are more cooperative with health care workers now. There are still some issues have to be considered in order to implement this policy more successfully. Well trained public health personnel is a pivot, care should also be offered to rural areas where large amount estimated AIDS cases occurred, patients who enrolled in to AVT should keep adherence in order to prevent drug resistance (*Xing et al, 2005*).

Accompanying with the improvement of HIV/AIDS surveillance in China, the budget invested on HIV/AIDS prevention, intervention, care, and vaccine research has increased simultaneously. In 2001, the Chinese government allocated 1.8 million USD for its national AIDS budget, AIDS funding in 2001 was 12.4 million USD (*Xinhua Agency, 2001*), the AIDS budget increased significantly to about USD

12 million in 2002 (Zhu, 2003). The Chinese government increases input for HIV/AIDS prevention and control, moreover, input for HIV/AIDS prevention and control also increased at provincial level. Based on data from 29 provinces, the total direct allocation was USD 7 million from the provincial government in 2002 (UNGASS, 2002). In 2003, Chinese government allocated 350 million USD to support every province to improve the basic infrastructure of provincial CDC (former provincial anti-epidemic station) (China Daily, 2003); in the same year, China MOH announced 1.2 billion USD would invest in the following three years to develop an emergency public health response system at the national, provincial and local levels (Cui, 2003), 272 million USD also invested to strengthen China's blood testing centers in the central and western regions where HIV epidemic once was prevalent among commercial plasma donors (Xinhua Agency, 2003a).

The spread of HIV/AIDS is becoming more and more a serious social problem in China, many of Chinese people take an indifferent attitude towards or condemn AIDS patients (Sun et al., 2007). Because of low awareness of AIDS among the general public, discrimination against people with HIV/AIDS and their families is still a big problem in China (Zhang et al., 1999). Stigma and discrimination are accompanying the epidemic since the first case emerged, HIV infection occurs mainly already social marginalized groups, e.g. drug users, FSWs, MSM; therefore, the stigma attached to HIV is added based on pre-existed stigma towards social marginalized groups (Green, 1996); Stigma and discrimination is also a main barrier of HIV/AIDS prevention in China (Williams, 2007), it is crucial to overcome stigma and discrimination to win the war against AIDS. Social and cultural discrimination prevents people from wanting to know more about HIV/AIDS, and makes it even hard to prevent HIV transmission (Deng et al, 2007). Stigma and discrimination are also very dangerous in that they may push the HIV-affected group to be marginalized, and to commit criminality and destabilizes society (Holzmann et al., 2003). However, denial, resistance and non-cooperation won't get rid of the epidemic, it could follow by the nightmare of a full-blown health crisis (World Bank, 1997); government should do his best to disseminate the knowledge of HIV/AIDS to public, to design effective communication strategy to break the silence

of AIDS, establish supportive public policy and overcome stigma and discrimination (*Singhal & Rogers, 2003*).

The 2003 Chinese “Four Frees and One Care” policy was a landmark in war against HIV/AIDS, it provides medical, social, moral and economic support for HIV infected and AIDS patients (*MOH, 2004*); obviously, to achieve this goal will require an infrastructure that not only provides operational and financial support, but also develops an environment in which drug users and other marginal population groups feel comfortable and safe in seeking help and non-discrimination (*Shao, 2006*).

In 2006, with the help of CDC, China CDC initiated test-run HIV-1 BED assay to estimate the HIV incidence among target population (*China CDC, 2006b*). HIV incidence reflects the extent of HIV infection is occurring. HIV incidence can be used to appropriately allocate prevention resources to those most vulnerable to HIV transmission, it helps to identify and detect masked or missed sub-epidemics, monitor the new emergence of HIV sub-epidemics in the general population, and measure the effect of prevention programs (*CDC, 2005*).

HIV incidence is the more accurate information to plan the targeted HIV prevention to measure the impact of HIV prevention programs; however, it is hard to measure. With the expanding anti-retroviral treatment programs, interpretation of HIV prevalence survey data will become more complex, HIV incidence estimates become more valuable as an additional data source (*Hu et al., 2003; Lu et al., 2006*). BED HIV-1 incidence assay has launched in high HIV-1 prevalence provinces; e.g. Yunnan, Xinjiang, Sichuan, Chongqing, Guangxi and Guangdong since 1996 (*China CDC, 2007*). It provided more useful information for understanding the changing of HIV epidemic and risk behaviours.

China has a strong centralism politics, HIV/AIDS program could only be successful with government support; Chinese government has strengthened HIV/AIDS control efforts, improved and perfected HIV/AIDS policy, increased AIDS funding, and closely collaborated with international organizations.

Some actions must be done by Central Government, necessary laws and regulations should be promulgated to enhance administration, and a network should be formed to combine publicity and education, health access to all, monitoring administration and follow-up services. The Chinese Government needs more openness to develop a quality AIDS policies for acknowledging the seriousness and potential of the epidemic. The AIDS response at all levels needs to be widened, and involve multiple sectors beyond the purely medical sector. Government plays a important role in training medical personnel in order to remove the discrimination against HIV-infected patients. Improving AIDS awareness needs capacity building, training, information dissemination, and efforts at promoting life skills and healthy life styles among public.



# **Chapter V**

## **CONCLUSION**

*“Think globally, act locally”*

After more than two decades of emerge of HIV/AIDS, it is not only considered as the worst public health disaster, but also as a social and economic crisis. HIV/AIDS has emphasized the interaction between human behavior, community, health and disease, it is an increasing challenge to countries all over the world, both directly as a public health issue and indirectly through the human capital and economic loss. China's HIV/AIDS epidemic is associated with illiteracy, poverty, population mobility, and gender inequality. The major mode of HIV transmission in China is injecting drug use. By the end of 2005, there were approximately 650,000 people living with HIV/AIDS in China; in which 288,000 were drug users living with HIV/AIDS, accounting for 44.3% of the total number of estimated HIV cases (*MOH, 2006*).

Since the first emerge of HIV/AIDS, HIV surveillance has become a core function of national HIV/AIDS programmes (*WHO, 1988*). AIDS cases reporting has been used as the primary AIDS surveillance tool since the epidemic, currently, HIV sentinel surveillance is the main epidemiological tool used to monitor trends in HIV infection prevalence in various population groups in a country, since 1999, WHO and UNAIDS initialled “second-generation” surveillance, it integrated biological surveillance — i.e. HIV sentinel surveillance, reporting of AIDS cases, and surveillance of sexually transmitted infections (STIs) — and behavioural surveillance, it is comprised the core component of current surveillance systems (*UNAIDS/WHO, 2000*).

HIV surveillance system in China mainly includes HIV/AIDS case reporting system and HIV sentinel surveillance system, there are also a number of special studies focusing on HIV infection related behaviours as supplement (*CDC, China/CDC; 2002*). Since 1999, China began conducting second generation surveillance targeted high-risk groups, vulnerable groups and the general public, e.g. drug users, FSWs, STD clinic attendees, MSM, long distance truck drivers, and young students (*NCAIDS, 2001*). China now has in place a surveillance network that covers all 31 provinces, autonomous regions and municipalities. Much more information than in the past is now available on epidemiological trend and risk behaviour.

HIV transmission in China has been mainly due to misuse of injectable drugs. In 2003, the number of registered drug users was 1.05 million of which 643,000 used heroin; in which 74 percent of drug users are under the age of 35 and 80 percent of detained female drug users were also engaged in commercial sex (Luo, 2004). By the end of 2004, there were totally 1.14 million registered drug users in China (NNCC, 2002, 2005; Liu et al, 2006-a; Chu & Levy, 2005). Risk behaviours among drug users are mainly due to injecting drug and needle-sharing, and unprotected sex among drug users and their partners (Zheng et al, 1994). Yunnan is one of the areas of China with alarmingly high rates of drug use. Yunnan also has one of the highest prevalence rates of HIV infection. Intravenous drug use and sharing of needles are the primary causes of HIV/AIDS transmissions in the region. A number of studies have found HIV infection spread from Yunnan to other parts of China (Zheng et al, 1994; Beryer et al, 2000; Piyasirisilp et al, 2000; Lai et al, 2001; Ruan et al, 2005; Zhang et al., 2006).

A big part of drug users in China are young heterosexual men. These men have the potential to transmit HIV-1 to their sexual partners: commercial sex workers, girlfriends, wives, etc., many who do not have the awareness of condom use (Tucker et al, 2005). Male drug users have the characters of multiple heterosexual partners and low condom use rate in comparison to male not use drug; and female drug users are high likely to engage commercial sex. Thus, the connection of injecting drug and unprotected sex could form a “bridge” of HIV transmission from risk population to general population. Not only drug users who have connection with general population form the bridge, female sex workers, young migrant population and MSM who also engaged heterosexual intercourse are also components fuelling the epidemic to accelerate the transmission from high risk group to general population.

In this study, factors that significantly associated with HIV prevalence are minority status, lower education, injecting drug and sharing needles; factors significantly associated with syphilis infection are female IDUs with lower education and minority status (See Chapter III). A comprehensive program to prevent the further

transmission of HIV among drug users has been implemented in China that includes community based harm reduction programs, mainly methadone maintenance treatment and needle-syringe program, and safe sex education and condom promotion programs.

In order to use surveillance data effectively for programme planning, programme monitoring and evaluation, and advocacy; the quality of surveillance data must be guaranteed. Surveillance system should combine HIV surveillance, STI surveillance, and behavioural surveillance. Before surveillance data are collected, investigator should have some ideas of how they will be used in planning and evaluating programmes or in advocacy. Data collection is not merely for analysis, it is used for protection of people not infected, and care of people already infected. HIV/AIDS surveillance should have ability to assess the epidemic trends and monitor the effectiveness of prevention and care activities. Sites conduct surveillance on HIV prevalence in selected populations (e.g. sentinel site surveys) should be continued and improved. However, HIV case reporting data could not be neglected, it is also a core element of HIV surveillance. Confidentiality and anonymity should be guaranteed.

Surveillance data could be used in different level in a country, at the national level, the magnitude of the epidemic and its distribution in different geographical areas and subpopulations could be assessed with the help of national surveillance data; at regional and local level, surveillance data could be used to identify affected areas, to seek solutions and to design strategies appropriate to the varying epidemic.

HIV/AIDS surveillance should be flexible, needs and objectives could be changed according to the epidemic trend. At present, obtain more specific epidemiological data is important to understand well the effects of treatment, and to design better prevention and control interventions in risk population and in general population. Second generation surveillance system have made progress in China, not only in tracing the HIV epidemic trend, but also tracing sexually transmitted infection (e.g. syphilis) risk behaviours. Data of diseases associated with HIV/AIDS, particularly

tuberculosis and other opportunistic infections should also be collected systematically. China has planned to integrate HIV/AIDS surveillance system with STD surveillance system to allow for better interpretation and prediction of trends. Surveillance reports created by computing, interpreting and analyzing data collected from the HIV surveillance system; STD surveillance, HIV/AIDS reporting, behavioral surveillance and other epidemiological research published by China CDC AIDS/STD center quarterly and annually (*China CDC, 2005*). An effective surveillance system can orient the national AIDS strategy, trace HIV/AIDS trends, and provide early-warning the public of any coming epidemic.

Since 2003, free anti-retroviral therapy has provided under “Four Frees and One care” policy, the anti-retroviral therapy is developed and monitored and documented by national HIV/AIDS clinical team. By the end of 2006, there were more than 30,640 patients have been treated in mainland China (*Wu et al, 2007*). Consideration of side effect and drug resistance, China has established viral load and resistance monitoring system and trained clinicians and health care professionals to understand the drug resistance and appropriate drug regimens (*Zhang et al., 2006a; Shao 2006a*). In March 2006, the first legislation directly related to HIV/AIDS was issued by State Council of China: The AIDS Prevention and Control Regulations (*State Council, 2006*). It was a decisive measure that Chinese government has recognized that HIV/AIDS is not only a pure public health issue, its impact will impair economic and social development, all sectors that related to the prevention and control of HIV/AIDS must integrate. A national HIV/AIDS prevention and control committee has set up headed by vice-prime minister; and each province has set up its subsidiary office correspondingly.

The epidemic is growing in different parts of China, it is getting even more fugacious, thus, the surveillance system should emphasize on support for decision making, not merely data collection; surveillance activities should be adjusted to the needs of the community. Underreporting of HIV infection and imbalance between urban and rural areas are the two major barriers on AIDS epidemiological analysis and implementation of prevention strategy. Rural areas are lack of resources to carry

out extensive surveillance, and the infrastructure in rural areas is weak. Additionally, current surveillance protocols primarily cover mainly specific high risk groups and in specific regions. More efforts are needed to promote an integration of the whole society to create an environment in which drug users and other marginalized population groups feel comfortable and safe in seeking help, community settings should provide resources for information, social interactive support, crisis resolution, and social integration and non-discrimination (*Trickett, 2005*). It is of great importance that intervention and prevention strategy for a target population group must be based on the unique risk circumstances of this group, though standard principles have been issued for effective risk reduction counselling (*Kerry 1995*).

HIV/AIDS as a national development threat, is not purely a medical and health problem, it requires a multidisciplinary approach for its prevention and care. AIDS is not simply a public health problem. It is rather a complex social problem. The whole society should and must get involved and share responsibility for actively working together to solve this problem. Chinese Government must not miss any opportunity to implement all HIV prevention and control policies and measures to reduce the impact that HIV causes to the people and society.

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B04 Resident place            ① local resident            ② transient resident (Please notice  
Province) \_\_\_\_\_

B05 Nation \_\_\_\_\_

B06 Education                ① illiteracy    ② primary school    ③ middle school  
   ④ high school    ⑤ college or above

B07 Profession                ① Student    ② Teacher    ③ Nursemaid    ④ food industry  
   ⑤ commercial service    ⑥ medical staff    ⑦ industrial worker  
   ⑧ mobile worker    ⑨ peasant    ⑩ farmer    (11) fisher/seaman  
   (12) white collar    (13) pensioner    (14) house worker/no job  
   (15) other (please, notice) \_\_\_\_\_

C01 Can a person who infected HIV looks health?

① Yes    ② No    ③ Not know

C02 Can a person infects HIV through transfusion HIV infected blood or blood product?

① Yes    ② No    ③ Not know

C03 Can a person infects HIV if he/she shares needles with HIV infected person?

① Yes    ② No    ③ Not know

C04 Can the risk of transmission HIV decreases if condom is used properly by sex at every time?

① Yes    ② No    ③ Not know

C05 Can the risk of transmission HIV decrease if you have a non-infect fix sex partner?

① Yes    ② No    ③ Not know

C06 Can a HIV infected pregnant woman transmit HIV virus to her unborn child?

① Yes    ② No    ③ Not know

C07 Can a person get HIV infection if he/she shares meat with HIV infected person?

① Yes    ② No    ③ Not know

C08 Can mosquito bite transmit HIV virus?

① Yes    ② No    ③ Not know

C09 In the last year, have you ever tested for HIV?

① Yes    ② No (*Skip to D01*)    ③ Not know

C10 Do you know the test result? (Do not need tell me the result)

① Yes    ② No

D01 At what age did you use drug first time?

D03 Did you ever inject drug? ① \_\_\_age ② reject

① Yes ② No (*skip to D11*) ③ Reject

D04 At what age did you inject drug for first time?

① \_\_\_age ② Reject

D05 Have you ever injected drug in last one month?

① Yes ② No ③ Reject

(*for drug user in detox center, last one month means one month before going into detox center*)

D06 Did you ever share needles with other person?

① Yes ② No (*skip to D10*) ③ Reject

D07 Did you share needles with other person by last time injection?

① Yes ② No ③ Reject

D08 Did you share needles with other person by injection in last one month?

① Yes ② No ③ Reject

(*for drug user in detox center, last one month means one month before going into detox center*)

D09 How often did you share needles with others when you injected drug in last 6 months?

① Never ② Occasionally ③ every time ④ Reject

D11 Have you ever been in detox center? (*for drug user already in detox center, please choose ①*)

① Yes ② No ③ Reject

E01 Have you had sex in last month?

① Yes ② No (*skip to E03*) ③ Reject

E02 Did you use condom by last sex?

① Yes ② No ③ Reject

G01 In last one year, have you got commercial sex through paying or offer drug?

① Yes ② No (*skip to H01*) ③ Reject

G02 In last one year, how many commercial sex partners have you had through paying or offer drug?

① \_\_\_person ② can not remember ③ Reject

G03 Did you use condom by last commercial sex?

① Yes ② No ③ Reject



G04 How often did you use condom with such commercial sex partner in last one year?  
① Never                      ② Occasionally                      ③ every time                      ④ Reject

H01 In last one year, have you provided sex service in order to get pay or drug?  
① Yes                      ② No (*skip to I01*)                      ③ Reject

H02 In last one year, how many commercial sex partners have you had in order to get pay or drug?  
① \_\_\_person                      ② can not remember                      ③ Reject

H03 Did you use condom with last commercial sex partner?  
① Yes                      ② No                      ③ Reject

H04 How often did you use condom with such commercial sex partner in last one year?  
① Never                      ② Occasionally                      ③ every time                      ④ Reject

J01 In the last year, have you got following symptoms: emiction ache/burn, urethra/vagina secretion abnormal, genitals derma trauma/hyperplasia?  
① Yes                      ② No (*skip to K01*)                      ③ Reject

J02 How did you handle it if you had above symptoms? (*multiple choice possible*)  
① to STD clinic                      ② to general hospital                      ③ to private clinic                      ④  
bought medicine by self                      ⑤ did nothing                      ⑥ to woman health hospital  
⑦ other (please, notice) \_\_\_\_\_                      ⑧ Reject

In last year, have you ever got following HIV prevention services?

K01 Needle exchange/clean needle distribution

① Yes                      ② No

K02 Methadone

① Yes                      ② No

K03 Partner education

① Yes                      ② No

K04 Condom distribution

① Yes                      ② No

K05 HIV counseling and test

① Yes                      ② No

K06 AIDS/STD brochures

① Yes                      ② No

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End of interview, thanks for your co-operation.

## Summaries

### National HIV/AIDS second generation surveillance on drug users in 2005 in China

#### 1. Abstract

**Aim:** To determine prevalence of HIV-1, risk behaviours and demographic characteristics associated with HIV-1 infection among drug users in China based on the national second-generation surveillance on drug users in 2005.

**Methods:** National HIV/AIDS second-generation surveillance is a routine work in China; the data on drug users in 2005 were analysed; HIV-1 antibody status was obtained from blood tests; demographic and behavioural data were collected through standardized interviews. In total, 6539 records from 21 surveillance sites were obtained. After data cleaning, a total of 5890 records were included in the analysis. Logistic regression was used to analyse independent association between HIV-1 status and risk behaviours.

**Results:** HIV-1 antibody prevalence was 5.0%, with large regional differences. 52.7% drug users in this study once injected drug, HIV-1 antibody prevalence was 6.6% among injecting drug users. Syphilis antibody prevalence was 2.8%. Based on logistic regression analysis, demographic and behavioral factors significantly associated with HIV prevalence were: minority versus Han-Chinese (OR 4.10; 95% CI 3.03-5.55;  $p < 0.001$ ), education  $\leq 9$  years versus  $> 9$  years (OR 1.61; 95% CI 1.20-2.15;  $p = 0.001$ ), injecting drugs without needle-sharing versus not injecting (OR 2.49; 95% CI 1.77-3.52;  $p < 0.001$ ), injecting drugs with needle-sharing versus not injecting (OR 4.44; 95% CI 3.19-6.19;  $p < 0.001$ ).

**Conclusion:** Prevalence of HIV-1 infection among drug users in China is relatively high (5%) and the risk of HIV-1 infection is associated predominantly with minority status, education equal or smaller than 9 years, and injecting drug use. Special interventions among drug users in China are warranted.

**Keywords:** HIV/AIDS, drug user, IDU, China

## **2. Summary**

### **Introduction**

Injecting drug use (IDU) is the major mode of HIV transmission in China (China CDC, 2003). Historically, drug abuse in China referred only to the smoking of opium. In late 1980s, heroin abuse first emerged as a problem in China's border regions with the opium-growing countries (Zhang & Ma, 2002; UNAIDS, 2000). The progression from non-injecting to injecting drug-use is now increasingly common (UNAIDS, 2000). Drug use is illegal in China, all identified drug users are registered by Public Security Bureau. By the end of 2004, there were cumulative 1.14 million registered drug users in China (Liu et al., 2006-a). However, the real number of drug users in China could be much higher, since drug users may try to avoid registration which is potentially associated with being arrested. A study in central China found that 45%-92% of all drug users in 4 investigated cities injected drugs at least once (Cheng et al, 2003). Widespread drug injection was an early source of HIV infection in China especially in the southern border provinces. The rapid increase in heroin injecting in this population appears to have triggered an explosive HIV epidemic (Xiao et al, 2007). Up to the end of 2004 injecting drug users (IDUs) accounted for about 70% of total cumulative reported HIV infections in China (China CDC, 2005). The number of provinces that have reported HIV infections among IDUs increased from one province in 1994 to 21 provinces in 1999 (China CDC, 2003). By the end of 2005, there were approximately 650,000 people currently living with HIV/AIDS in China, including approximately 288,000 drug users (both IDUs and non-IDUs), accounting for 44.3% of the total number of estimated HIV cases. Outbreaks of HIV infections have been reported among IDUs in Yunnan, Xinjiang, Guangxi, Sichuan, and Guangdong provinces and autonomous regions (China CDC, 2005). HIV prevalence among IDUs has reached 20%-30% in some areas in these provinces, and even reached 60%-80% in Ruili, Yunnan Province and in Yining, Xinjiang Autonomous Region. Seven provinces – Yunnan, Xinjiang, Guangxi, Guangdong, Guizhou, Sichuan, and Hunan – each have more than 10,000 drug users infected with HIV, and

these 7 provinces account for 89.5% of the HIV/AIDS cases among drug users in China (WHO, UNAIDS; 2006).

Frequent risk behaviours for HIV infections among IDUs are needle-sharing, and unprotected sex (Zheng et al, 1994). Despite information campaigns large numbers of IDUs in China continue to share equipment (73% in Hunan, 81% in Jiangxi and 100% in Xinjiang) (China CDC, 2004/MAP, 2005). Also unprotected sex is common and the increasing of HIV prevalence among commercial sex workers, many of whom inject drugs, may lead to spread of HIV into the general population (Zhang & Ma, 2002).

HIV surveillance system in China includes HIV/AIDS case reporting system and HIV sentinel surveillance system, there are also a number of special epidemiological studies focusing on HIV related behaviours as supplement (China, CDC/CDC; 2002). HIV/AIDS case reporting was set up at the national level in 1985 (Yuan & Li; 1997). HIV/AIDS case reporting is a passive HIV surveillance tool, all identified HIV infection and AIDS cases are reported to China CDC through net-based direct reporting system with an individual code to avoid multiple registration, and a nationally standardized form is used for HIV/AIDS case reporting, this form includes demographic information such as gender, age, resident place and nation; and HIV/AIDS related co-infection and syndromes.

The passive reporting is supplemented by HIV surveillance which is targeted towards selected population groups, which was launched in China since 1995 (Xinhua News Agency, 2003). China CDC and provincial CDCs are responsible for national and provincial sentinel surveillance, respectively. In 1999, the second generation surveillance was initiated. HIV/AIDS second generation surveillance combines HIV sero-prevalence surveillance and behavioural surveillance, in difference to standard sentinel surveillance which focuses on HIV sero-prevalence data only. Up to the end of 2005, there were total 105 comprehensive (second generation surveillance) sentinel sites in China focusing on drug users, female sex workers, STD clinic clients, MSM, male long distance truck drivers and students (China CDC, 2005). The number of

sites collecting data each year is selected based on local HIV epidemic level and resource availability. Priority should be given to keep the sustainability of sentinel site, it means the same sites should be selected inner province, and new sites should be added. Provinces that HIV prevalence among drug users over 5% should set at least 1 surveillance site, sites in provinces that HIV prevalence among drug users below 5% or HIV positive was not found could also be selected to compare the difference of demographic characteristics and risk behaviors in different sites. Factors like local socio-economical level, local medical resource, and floating population should also be considered when decide to set surveillance sites.

The aims of our analysis are to describe the results of second generation surveillance among drug users in China conducted in 2005, to assess the prevalence of the HIV infection, risk behaviours and their relationship to each other accounting for regional differences.

## **Method**

### **Study sample**

In 2005, according to the HIV prevalence obtained from HIV/AIDS case reporting system and other epidemiological studies in every province associated local resource in different regions, 22 drug user sentinel sites from 14 provinces were selected in 2005. Each site was requested to provide between 300 and 400 participants. In order to avoid prosecution by law and increase participation, anonymity and confidentiality were guaranteed to the drug users when they participated in the surveillance. The participants can be recruited from community where most drug users reside and use drugs, from detoxification centres and from other places like bars, street outreach which different from drug user communities etc. The sampling methods that used for recruiting drug users could be convenience sampling method and snowball sampling method. Convenience sampling method means investigators interview with key informants, local surveillance department, Public Security Bureau and community members that who know the places where local drug users reside and use drugs. If the

drug user found by this way rejects to be investigated, next drug user could be recruited and so on until the expected sample size is reached. Snowball method is that investigators should find a key informant or a drug user recognized by local surveillance department and this informant or drug user gives the names, address, and other contact information of second drug user (or second group of drug users) for investigation, who provides the names, address, and other contact information of third drug user (or third group of drug users) in the same way, and so on to increase samples through snowball sampling process until the expected number of sample size is reached. The blood specimen was collected on-site and tested in provincial CDC.

Drug users from community have the better representativeness, because drug users in community are random distributed, but there are difficulties to recruit enough subjects because of their hidden behaviours. Drug users at detoxification centers are easily to recruit and cooperate but have a problem in representativeness. Each sentinel site should be based on their local situation to try the community-based surveillance.

Data collection period was from July to September 2005, but could be prolonged in the case sites were not able to collect the requested number of cases. If so, the needed size of samples was still not reached, then local investigators could contact China CDC who decided to end the sampling process. During the surveillance period, questionnaire survey was conducted and serum specimen were collected from all samples who participated survey. HIV antibody status was obtained from blood tests; demographic and behavioural data were collected through standardized interviews.

Two ELISA assays were used for testing HIV antibodies. In blood specimens with positive result in the first ELISA assay, a second (different) ELISA assay was performed. Specimens with positive results in both ELISA assays were considered positive for HIV test.

First HIV ELISA test: ELISA reagent: (Wantai Biotech, Beijing, China)

Second HIV ELISA test: ELISA reagent: (Vironostika HIV Uniform II Ag/Ab. Akzo Organon Teknika, Netherlands).

Variables used in this study included sample source, gender, age, marital status, resident place, nation, education background, profession, monthly income, age at first drug use age, use of injecting drug and needles sharing, number of commercial sex partners in last 12 months, and STD symptoms in last 12 months.

Age at the time of survey was recoded into two categories: less than 30 years and more. Marital status originally included 4 categories: single, married, cohabiting, and divorce/widowed; but of the purpose of the analysis was collapsed into 2 categories: living alone (single and divorce/widowed) and living with partner (married and cohabited). Resident status included 2 categories, local resident and transient resident. There are totally 56 nations in China, all non-Han samples were categorized to minority category. Education background originally included 5 categories: illiteracy, primary school, middle school, high school, and college or above; for the purpose of analysis it was collapsed into 2 categories: equal or less than 9 years of education (illiteracy, primary school, middle school), and more than 9 years education (high school and college or above). There were originally 15 profession categories: 1 Student, 2 Teacher, 3 home maid, 4 service industry personnel, 5 shop assistant, 6 medical staff, 7 worker, 8 migrant worker, 9 peasant, 10 farmer, 11 fisher, 12 officer, 13 pensioner, 14 home worker, 15 other; for the purpose of the analysis they were collapsed into 2 categories: white collar (student, teacher, medical staff, officer, pensioner) and blue collar (all rest categories). Monthly income was subdivided into four categories according to the socio-economical situation in China: equal or less than 600 RMB (Chinese Currency, 1\$=7.73RMB; 600 RMB is general considered as minimal life standard in China, however, there is a big socio-economical disparity in different regions), 601-2000 RMB and more than 2000 RMB per month). In one third of the sample income information was missing and the respondents were classified into missing category. Age at the time of first drug use was recoded into two categories according to the frequencies: younger than 30 and older than 30. Information about injecting drug use and needle sharing was investigated by several questions, with different time intervals. We used only the information on ever use of injecting drug and ever needle sharing and coded it into a single category.

Respondents were asked whether they had any commercial sex partners in the last 12 months. If yes they were asked about their number. Respondents were also asked about any of following symptoms of sexually transmitted infections in the last 12 months as ache/burn during miction, abnormal urethral or vaginal secretion, genital warts.

### **Data analysis**

There were totally 6539 samples from 21 surveillance sites which conducted survey, one site in Kunming, Yunnan province was excluded for lack of information about risk behaviour.

First, data cleaning was conducted, in which 649 samples were deleted. In 621 cases no blood test was performed (blood samples were either insufficient for conducting HIV test, blood taking was not successful or the participants rejected). In one case first HIV test was negative and the second positive, but second test should be performed only if the first test was positive. In 26 cases age of the first drug use was below 10 and additionally in one case the age was reported as 13 years. All other participants reported first age use starting from 14 to 60, we therefore decided to consider the 27 cases as coding errors.

After data cleaning, a total of 5890 records were included in the analysis. SPSS software (version 14.0 for Windows; SPSS Inc., Chicago, IL) is used to analyse the dataset,  $\chi^2$  statistics with *P*-values were used to compare HIV prevalence associated with demographics, drug use and sexual risk behaviours. Logistic regression was used to analyse independent association between HIV status and risk behaviours.



## Results

### Characteristics of the sample

Among the 21 survey sites, there were 14 sites with more than 200 records available (Sichuan Dazhou, Zhejiang Hangzhou, Guangxi Nanning, Xinjiang Kashi, Hubei Xiaogan, Gansu Wuwei, Hebei Shijiazhuang, Guizhou Qianxinan, Chongqing, Guizhou Tongren, Guangdong Dongguan, Hubei Jingzhou, Sichuan Liangshan, and Qinghai Haixi), for 5 other sites there were 100-200 records (Anhui Huainan, Anhui Maanshan, Qinghai Haidong, Sichuan Leshan, and Gansu Dingxi) and for two sites (Liaoning Fushun and Xinjiang Yili) less than 100 records.

About half of respondents originated from detoxification centres, one third from community, and the remaining from other surveillance places. The sample was predominantly male with 5.6:1 male-to-female ratio. Age range was between 14 and 78 years, with a median of 30 years. About half of the respondents were living alone, the second half was either married or living with a steady partner. Most drug users were local residents (had local permanent resident permission) and two thirds were Han Chinese. Two thirds had education of more than 9 years (which includes high school and above) and also two thirds were blue collar workers.

80% of the participants initiated drug use before age of 30 years, here again several responses were missing. About half of the sample did never inject drugs (thus being drug users but not injecting drug users). Among the IDUs 44.1% ever shared needles.

87% had no commercial sex partners in last 12 months before the time of interview, 2% had at least one sex partner, with a large variation, but for 11% the information was missing. Among persons who had commercial sex, 36.8% used condom by latest commercial sex. 14% of participants experienced any STD symptoms in the last 12 months before the interview.

The overall HIV-1 antibody prevalence was 5.0%; it was 6.6% among IDUs and 3.5% among non-injecting drug users. Several sites showed no HIV-1 cases in the sentinel

samples, but in some regions the prevalence was as high as 10 to 30% (Guangxi Nanning 21.0%, Xinjiang Kashi 10.8%, Sichuan Liangshan 29.4%). The proportion of IDUs among the sentinel sites was very different, the proportion of IDUs as a whole accounted for 52.7%, needle-sharing rate among IDUs was also quite higher, almost 50% IDU once shared needles; in five sites that HIV-1 prevalence over 5%, 97.6% drug users in Guangxi Nanning were IDUs, 91.0% drug users in Chongqing were IDUs, 66.7% drug users in Guangdong Dongguan were IDUs whereas only 36.2% and 17.6% drug users were IDUs in Sichuan Liangshan and Xinjiang Kashi, respectively. Even in sites that no HIV positive was found, there was a big difference of the proportion of IDU among drug users, e.g. Non IDUs accounted for 97.9% in Gansu Dingxi, 98.3% in Gansu Wuwei, and 94.4% in Qinghai Haixi, respectively; whereas, IDUs accounted for 66.9% in Hebei Shijiazhuang, 96.4% in Liaoning Fuhun, and 81.6% in Xinjiang Yili, respectively. The big part of samples (87.3%) have had not any commercial sex partners in last 12 months, However the missing values account for 11.2%, in some sentinel sites, the missing values are even over 20%, analysis related to the commercial sex behaviours should be cautious for higher proportion of missing.

Bivariate analysis showed several associations between the investigated variables and HIV-1 antibody status. HIV prevalence was significantly associated with the source of the sample ( $p<0.01$ ), younger age ( $p<0.05$ ), being resident versus transient ( $p<0.001$ ), being minority versus Han-Chinese ( $p<0.001$ ), higher versus lower education ( $p<0.001$ ), blue collar versus white collar ( $p<0.001$ ), age of first drug use ( $p=0.05$ ), injecting drugs, and sharing needles ( $p<0.001$ ).

Based on logistic regression analysis, demographic and behavioral factors significantly associated with HIV prevalence were: minority versus Han-Chinese (OR 4.10; 95% CI 3.03-5.55;  $p<0.001$ ), education  $\leq 9$  years versus  $>9$  years (OR 1.61; 95% CI 1.20-2.15;  $p=0.001$ ), injecting drugs without needle-sharing versus not injecting (OR 2.49; 95% CI 1.77-3.52;  $p<0.001$ ), injecting drugs with needle-sharing versus not injecting (OR 4.44; 95% CI 3.19-6.19;  $p<0.001$ ).

## **Discussion**

The HIV/AIDS second generation surveillance data from 2005 showed HIV-1 antibody prevalence of 5.0% among drug users and 6.6% among IDUs. The data displayed also considerable differences in prevalence of HIV and risk behaviours between investigated regions. In several sentinel sites no HIV cases were recorded, whereas in others the prevalence was as high as 21% (Guangxi Nanning), 10.8% (Xinjiang Kashi), and 29.4% (Sichuan Liangshan).

HIV/AIDS second generation surveillance is a cross-sectional survey. In order to guarantee the representativeness and avoid the potential arrest of the samples' illegal behaviours in China, anonymity and confidentiality are assured among drug users surveyed in second generation surveillance (China CDC, 2006). In most cases the sample size was less than was planned, and missing values impacted the analysis outcome, it should be paid attention for the henceforth surveillance to recruit enough samples, increase the quality of data and do best to decrease the missing values. Still, this study had several limitations.

Regions that HIV/AIDS epidemic dominate by drug users locate along south-western and north-western areas which border Laos, Myanmar, and Afghanistan. This study also demonstrated that higher HIV/AIDS prevalence regions locate in abovementioned areas. The issue of sample representativeness is decisive in cross sectional survey. Biases can arise when drug users selected in this study do not represent the general drug users in China, however, it is really difficult to reach the representativeness among drug users in China which is the most populous country in the world and big geographical and socio-economical disparity between different regions. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. For example, it is proved by a number of studies that HIV/AIDS prevalence among drug users in Xinjiang is really higher (Gill & Song, 2006), however, in this study, one site in Xinjiang there was no HIV positive found. A study in Xinjiang showed HIV prevalence among drug users was 24.5%, and among IDU was

significantly higher (56.1%) (Ni et al, 2006). Zhang et al. found in a cohort study in Xinjiang baseline HIV-1 prevalence among high-risk IDUs was 29% (228/781) (Zhang et al., 2007).

A site in Yunnan province was excluded because lack of key information of risk behaviour, HIV-1 sero-prevalence was 54% (54/100) in this site. Yunnan suffered first HIV epidemic in China, and accounted the biggest number of HIV infections in China. In 2004, the HIV-1 prevalence among IDUs in Yunnan was between 21.2%-27.8%. By the end of 2004, Yunnan had cumulatively reported 28,391 HIV infections (MOH, China/WHO; 2004). Selection bias is most important bias in surveillance. Selection bias can cause if the HIV-related behaviors in surveyed subjects are different from those who do not participate in the survey. Rejection to be surveyed among subjects is an important potential resource of selective bias. HIV-related behavioral surveillance usually involves in the subject's privacy or even the illegal behaviours, and the rejection-related bias can easily cause if the behaviours are different between subjects who reject survey and those who accept survey. Rejection bias may cause under-estimation of risk behaviours. The prevalence of HIV infection in this study could underrepresented the current situation among drug users in China.

Risk behaviours among drug users in China are mainly due to injecting drug and needle-sharing, and unprotected sex among drug users and their sex partners (Zheng et al, 1994). Injecting drug use is the primary mode of transmission of HIV transmission in China. The cumulative number of reported HIV positive cases from 1985 to 2004 was 89,067, in which IDUs accounted for 41% (MOH, China/WHO, 2004). The epidemic is characterised by a wide disparity between high and low prevalence regions. The prevalence rate among IDUs is quite higher in the south-western and north-western areas which border Laos, Myanmar, and Afghanistan. In some regions of Xinjiang, Yunan and Sichuan even over 50% (MOH, China/WHO, 2004). The major mode of HIV infection in the above four provinces with the highest reported cases of HIV/AIDS, including Yunnan, Xinjiang, Guangxi and Sichuan, is attributed to injecting drug use (MOH, China/WHO, 2004 & China CDC, 2003). In these regions, the proportion of minority population is much more higher than overall

8.4% minority of the entire population (Xiao, et al, 2007). In this study, the sentinel sites which the HIV-1 prevalence was over 5% in abovementioned higher prevalence regions were Guangxi Nanning 21.0%, Xinjiang Kashi 10.8%, Sichuan Liangshan 29.4%, respectively; definitely higher than other drug user sentinel sites.

High prevalence of HIV-1 among IDUs found by Zhang et al in a cohort study was 71.9% (174/242), needle/syringe sharing was the major risk factor, all three sites from Yunnan located along the drug trafficking route. Liu et al conducted a cohort HIV sero-incidence study among drug users in Guangxi found baseline HIV antibody prevalence was 25% (172/702), and risk factors were elder male drug users who injected drug and shared rinse water (Liu et al., 2006-b). A molecular study by Piyasirisilp et al in 2000 discovered that some subtypes BC and CRF of HIV-1 dominated among IDUs in Yunnan have spread through drug trafficking to the neighbouring provinces of Guangxi and to the west province of Xinjiang (Piyasirisilp et al, 2000). Beryer et al also found HIV-1 subtypes B, C, and a B/C recombinant subtype spread from Yunnan to north and west, to Xinjiang (Beryer et al, 2000). Zhang et al. studied HIV-1 patients in Yunnan using immunoassays found HIV-1 subtype C/CRF07\_BC/CRF08\_BC and CRF01\_AE were codominant among IDU, the discovery of many sexually transmitted CRF01\_AE cases was new and suggests that HIV-1 could be transmitted through “bridge population” into general population, this subtype may lead to a new epidemic in the general Chinese population (Zhang et al., 2006). Yu et al. found unprotected sex continued to occur at high rates among IDUs and their sex partners in Yunnan (Yu et al., 2003). The same phenomena also found in another HIV-1 molecular epidemiological study by Zhang et al. in 2004 in Xinjiang found HIV-1 infected by homo- or heterosexual transmission multiple subtypes of HIV-1 which were related to strains dominated among IDUs suggested HIV-1 has spread into general population (Zhang et al., 2004). Some other studies have found drug users were more likely to engage in high-risk sexual behaviours, and most female drug users engaged in commercial sex (Zhang et al., 2002; Yang et al., 2004; Qian et al., 2005; Tucker et al., 2005; Chu & Levy, 2005). In Dehong county, Yunnan province, HIV prevalence was over 1% in pregnant woman, HIV epidemic in Yunnan is already in a generalised phase (Cohen, 2004). A number of studies suggest

that HIV infection spread from high risk groups into the general population mainly due to sexual transmission (Zhang et al., 1999; Zhang et al., 2001; Huang et al., 2004; MOH, China/WHO, 2004; Hesketh et al., 2005; Zhu et al., 2005, Shao, 2006; Lonn et al, 2007).

This study provided useful information with respect to the HIV-1 prevalence, risk behaviours and demographic characteristics associated with HIV infection among drug users in China. However, any conclusions regarding to sexual risk behaviours should be viewed with caution based on the outcome of this study, because the proportion of missing values of sexual behaviour variables as a whole and in some sites was higher. Since the emergence of epidemic, China has launched HIV prevention and harm reduction program. A comprehensive program to prevent the further transmission of HIV among drug users has been implemented that includes community based harm reduction programmes, mainly methadone maintenance treatment and needle-syringe programme. In 2003, China announced a national AIDS control policy, “Four Frees and One Care” (free treatment, free Voluntary Counselling and Testing (VCT), free Prevention of Mother to Child Transmission (PMCT) and free education for AIDS orphans, and provision of social relief and care for HIV patients) (MOH, China/WHO, 2004). These efforts are likely to require an infrastructure that not only provides operational and financial support, but also creates an environment in which drug users feel comfortable and safe in seeking help and non-discrimination.

## **Erklärung**

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den verwendeten Werken wörtlich oder inhaltlich übernommenen Stellen kenntlich gemacht habe und dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt, oder mich anderweitig um Zulassung zur Promotion beworben habe.

A handwritten signature in black ink, appearing to be 'Zhang Weidong', written in a cursive style.

**Weidong Zhang**

**Bielefeld, Juni 2007**