

Systematic review of HIV and HCV infection among drug users in China

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Summary: To determine the HIV and hepatitis C virus (HCV) geographical distribution among drug users in China, a systematic literature review of 40 peer-reviewed publications (comprising 15,565 drug users) was conducted. Of the total drug users, 10,724 were found to be injection drug users (IDUs) and 4841 were non-injection drug users (non-IDUs). Various studies identified that among IDUs and non-IDUs, the overall HIV prevalence rates were 12.55% and 1.05%, and the HCV prevalence rates were 66.97% and 18.30%, respectively. The HIV prevalence rate ranged from 0% (Anhui and Inner Mongolia) to 52.51% (Yunnan) among IDUs, and from 0% to 19.80% among non-IDUs correspondingly. The HCV prevalence rate ranged from 11.43% (Shannxi) to 90.77% (Hubei) among IDUs, and from 0% (Anhui) to 40.00% (Fujian) among non-IDUs. Based on the high prevalence of HIV and HCV among drug users, scaling-up harm reduction was required from 'heroin trafficking areas' to other areas in China.

Keywords: human immunodeficiency virus (HIV), hepatitis C virus (HCV), prevalence rate, drug users, China

INTRODUCTION

Historically, China has had a long tradition with the consumption and cultivation of opium; by the end of the 19th century, it was home to millions of opium addicts. This situation remained largely unchanged until the middle of the 20th century.¹ It was following the founding of the People's Republic of China that concerted efforts were made to eliminate the use and cultivation of opium, and overall, the use of illicit drugs was controlled for several decades.^{2,3} Since the early 1990s, China has witnessed a dramatic, and incremental, increase in the consumption of illicit drugs, according to data from the National Narcotic Control Commission (Figure 1).⁴ At the end of 2005, there were 1.16 million registered drug users in China and around 700,000 heroin addicts, which account for 78.3% of total drug users.⁵ The most frequent route of drug administration was intravenous injection (50% to 70%). Although 'chasing the dragon' (inhalation of drug fumes) (55%) was a common route in initial heroin users, most drug users made the transition to injecting in order to achieve the same effect at lower doses, and to save on overall costs.⁴ Injecting of drugs and sharing of contaminated needles, and other injecting paraphernalia, have resulted in the transmission of HIV, leading to a high prevalence of HIV and AIDS among injecting drug users (IDUs).^{6,7} Research has shown that once HIV enters a community of IDUs the rapid spread of HIV is a likely outcome over a short period of time.⁸ The first drug user-related HIV infection case was reported in Yunnan Province as early as 1989.⁹ Comprehensive surveillance data in China show that 40% of IDUs share contaminated needles.¹⁰ By the end of

October 2007, the cumulative total of HIV and AIDS cases reported was 223,501 (including 62,838 AIDS cases and 22,205 recorded deaths). In China, of those found to be HIV positive or those with AIDS, IDUs represented 38.5% of registered HIV infections until 2007.¹⁰

Hepatitis C virus (HCV) can be transmitted by injection drug use and it has been identified as the most common viral infection affecting IDUs.^{7,11,12} Co-infection with HIV and HCV is common in certain populations, especially in IDUs.^{13,14} The presence of HIV accelerates the natural course of chronic hepatitis C, and HCV seropositivity could be a marker for accelerated HIV-1 disease progression.¹² In recent years, the Chinese government has implemented positive harm-reduction strategies to control the spread of HIV, AIDS, HCV and other sexually transmitted diseases among high-risk groups.¹⁵⁻¹⁸

Information about HIV and HCV infection, and HIV and HCV co-infection was obtained in separate studies but no overall profile of HIV and HCV co-infections and no detailed geographical variation studies in China were found to exist. This systematic review will present a detailed geographical distribution pattern of HIV, HCV infection and HIV and HCV co-infection among drug users of China. Findings from this literature review will provide important information to government officials to improve understanding of the high prevalence of HIV and HCV infection in China, and of the need to widen the harm-reduction response to tackle this epidemic.

MATERIAL AND METHODS

Study selection

The literature material was selected from citations listed in the English and Chinese literature databases: (Medline, EMBASE, Chinese Biomedical Literatures, China National Knowledge

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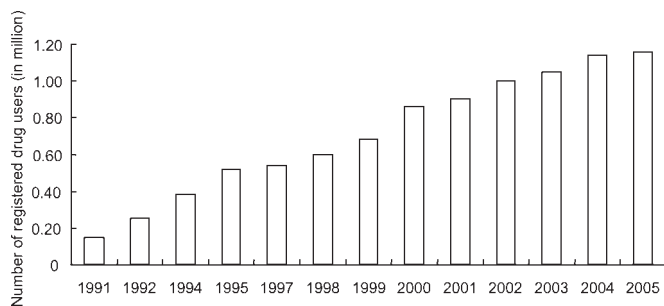


Figure 1 The number of registered drug users in China (1991-2005)

Infrastructure, Wan Fang and VIP). This review included peer-reviewed published literature of relevant epidemiology on HIV and HCV prevalence data among Chinese drug users, published from 1990 to May 2008. Key search terms included 'human immunodeficiency virus/HIV, hepatitis C virus/HCV, prevalence, drug user, drug abuser, China' and their Chinese counterparts. In addition, the reference list from each relevant article was explored to find other relevant studies.

This project was limited to studies that fulfilled the following inclusion criteria. (1) The blood sample was collected from the Chinese drug users. (2) A clear description of the methods of detection of HIV and HCV infection: samples were tested for antibodies to HIV by an enzyme-linked immunosorbent assay (ELISA), and all positive samples were confirmed by a Western immunoblot assay or other methods. Samples were considered as HIV-positive when both results were positive; samples were tested for antibodies to HCV by ELISA (3) and the detailed assay used in the detection and the information of the manufacturing company were presented. (4) Demographic and drug-use characteristics of clients were reported including age, sex, drug type and route of drug administration and sharing of needles. (5) Prevalence of both HIV and HCV infection of those identified as IDU and non-IDUs who still take illicit drugs but do not use injection, including oral, chasing the dragon, etc., as presented in each study. Studies that did not specify HIV or HCV infection among IDUs and non-IDUs were excluded by this review. (6) Sample sizes of more than 40 participants. If data or data subsets were from duplicated publications, only the publication with the largest sample size was included. If the sample size was the same, the earlier publication studies were preferred for inclusion in this systematic review.

Data abstraction

For each study, the following key information was obtained: first author, publication year, province or area of the sample, methods for detection of HIV and HCV, clients' demographic characteristics, and HIV and HCV infection and HIV-HCV co-infection prevalence as outcomes. Especially, the route of drug administration was classified as IDUs and non-IDUs. For studies comprising HIV and HCV prevalence across two or more areas or provinces, data were divided into area or province components, respectively.¹⁸

Data synthesis and statistical analysis

HIV or HCV infection prevalence data were expressed as the proportion of the number of HIV- or HCV-positive cases

among all the cases tested for HIV or HCV. The HIV and HCV infection prevalence and 95% confidence interval (95% CI) were pooled and stratified by province or area, and stratified by the route of drug administration. HIV and HCV co-infection was divided into HIV and HCV infection and each infection prevalence included both single and multiple infections. HIV and HCV prevalence was presented in descending order for different provinces or regions for IDUs and non-IDUs. Analyses were performed using STATA version 9.12 (Stata Corp., College Station, TX, USA).

RESULTS

Studies included

A total of 15,565 Chinese drug users from 40 studies published from 1997 to 2007 were included in the review^{13,19-57} of whom 10,724 (68.90%) were IDUs and 4841 (31.10%) were non-IDUs. Among 31 provinces and autonomous regions in the mainland of China, the data of 17 provinces and autonomous regions (54.84%) were available in this review. Of the 10,223 identified drug users found in the literature, 8590 (84.03%) were men and 1633 (15.97%) were women. Table 1 shows the distribution of all drug users identified with HIV and HCV infection from the 17 provinces and autonomous regions of China.

Estimation of HIV infection geographical distribution in drug users

The overall HIV detection rate among all drug users was 12.55% and 1.05% among IDUs and non-IDUs, respectively. The HIV was detected more frequent among IDUs (12.55%) than among non-IDUs (1.05%) significantly ($P < 0.0001$). The corresponding 95% CI of prevalence rate among IDUs and non-IDUs can be found in Table 2.

The large geographical variation of HIV prevalence among drug users was largely based on the route of drug administration. The results of the geographical distribution of HIV infection and 95% CI among IDUs and non-IDUs are presented

Table 1 Number, geographical distribution and route of drug administration among drug users in China

Province	IDUs	Non-IDUs	All drug users
Anhui ²⁰	42	53	95
Beijing ²¹	216	270	486
Fujian ¹²⁻¹⁴	1488	640	2128
Guangdong ²⁵⁻²⁸	1198	440	1638
Guangxi ^{18,19,29}	1280	0	1280
Guizhou ³⁰	83	83	166
Hainan ³¹	174	338	512
Hubei ^{32,33}	542	144	686
Hunan ^{34-36,19}	996	123	1119
Jiangsu ³⁷⁻⁴⁰	887	1069	1956
Jiangxi ⁴¹	121	95	216
Inner Mongolia ⁴²	477	255	732
Shannxi ⁴³	35	448	483
Sichuan ^{44-49,19}	1667	622	2289
Xinjiang ^{50-52,19}	857	42	899
Yunnan ⁴³⁻⁵⁵	518	101	619
Zhejiang ⁵⁶⁻⁵⁷	143	118	261
Total	10,724	4841	15,565

IDU = injection drug user; Non-IDU = non-injection drug user

Table 2 HIV infection among drug users by province in China

Province	IDU			Non-IDU			All drug users		
	HIV (%)	95% CI (%)	Range (%)	HIV (%)	95% CI (%)	Range (%)	HIV (%)	95% CI (%)	Range (%)
Yunnan	52.51	50.64–54.38	21.52–71.90	19.80	18.41–21.20	11.63–25.86	47.33	46.01–48.66	21.52–62.81
Xinjiang	41.31	40.61–42.01	30.35–63.71	11.90	11.90–11.90	11.90–11.90	39.93	39.21–40.66	28.30–63.71
Guangxi	16.95	16.85–17.06	14.71–19.05	–	–	–	16.95	16.85–17.06	14.71–19.05
Sichuan	15.12	14.68–15.56	4.46–48.65	3.54	3.17–3.90	0–9.61	11.97	11.58–12.36	1.58–48.65
Hunan	13.15	12.69–13.62	0.78–28.74	0	–	–	11.71	11.27–12.15	0.55–23.81
Zhejiang	10.49	8.92–12.06	0–18.99	0	–	–	5.75	4.68–6.81	0–18.99
Jiangsu	4.28	4.15–4.41	0–6.94	0.09	0.08–0.10	0–0.43	1.99	1.95–2.04	0–3.22
Guangdong	3.17	3.05–3.29	1.16–5.90	0.45	0.41–0.50	0–1.25	2.44	2.36–2.53	0.66–5.05
Shannxi	2.86	2.86–2.86	2.86–2.86	0	–	–	0.21	0.21–0.21	0.21–0.21
Beijing	2.31	2.31–2.31	2.31–2.31	0	–	–	1.03	1.03–1.03	1.03–1.03
Fujian	1.21	1.16–1.26	0–2.54	0	–	–	0.85	0.82–0.87	0–1.87
Guizhou	1.2	1.20–1.20	1.2–1.2	1.2	1.20–1.20	1.20–1.20	1.2	1.20–1.20	1.20–1.20
Jiangxi	0.83	0.83–0.83	0.83–0.83	0	–	–	0.46	0.46–0.46	0.46–0.46
Hainan	0.57	0.57–0.57	0.57–0.57	0	–	–	0.2	0.20–0.20	0.20–0.20
Hubei	0.37	0.28–0.46	0–3.23	0	–	–	0.29	0.23–0.35	0–2.25
Anhui	0	–	–	0	–	–	0	–	–
Inner Mongolia	0	–	–	0	–	–	0	–	–
Total	12.55	12.25–12.85	0–71.90	1.05	0.95–1.16	0–25.86	8.98	8.76–9.20	0–63.71

IDU= injection drug user; Non-IDU = non-injection drug user; CI = confidence interval

in Table 2. Among the 17 provinces and autonomous regions that identified HIV infection data, the prevalence of HIV among IDUs ranged from 0% in Anhui and Inner Mongolia to 52.51% in Yunnan Province. In descending order, other areas that identified a high prevalence of HIV (greater than 10%) among IDUs included Xinjiang (41.31%), Guangxi (16.95%), Sichuan (15.12%), Hunan (13.15%) and Zhejiang (10.49%). Provinces with a prevalence of HIV of 1% or more among non-IDUs included Xinjiang (11.90%), Yunnan (19.80%), Sichuan (3.54%) and Guizhou (1.2%). The prevalence

of HIV in non-IDUs found in Jiangsu and Guangdong was less than 1% and HIV infection was not detected among non-IDUs in other provinces. Among all the identified drug users, Yunnan Province had the highest prevalence of HIV (47.33%), followed by Xinjiang (39.93%), Guangxi (16.95%), Sichuan (11.97%) and Hunan Province (11.71%). Each of these five provinces can be found in the so-called 'China Channel' of drug smuggling from the 'Golden Triangle' (specifically Myanmar) and the Golden Crescent (specifically Afghanistan) to inner cities and abroad¹⁸ (Figure 2).

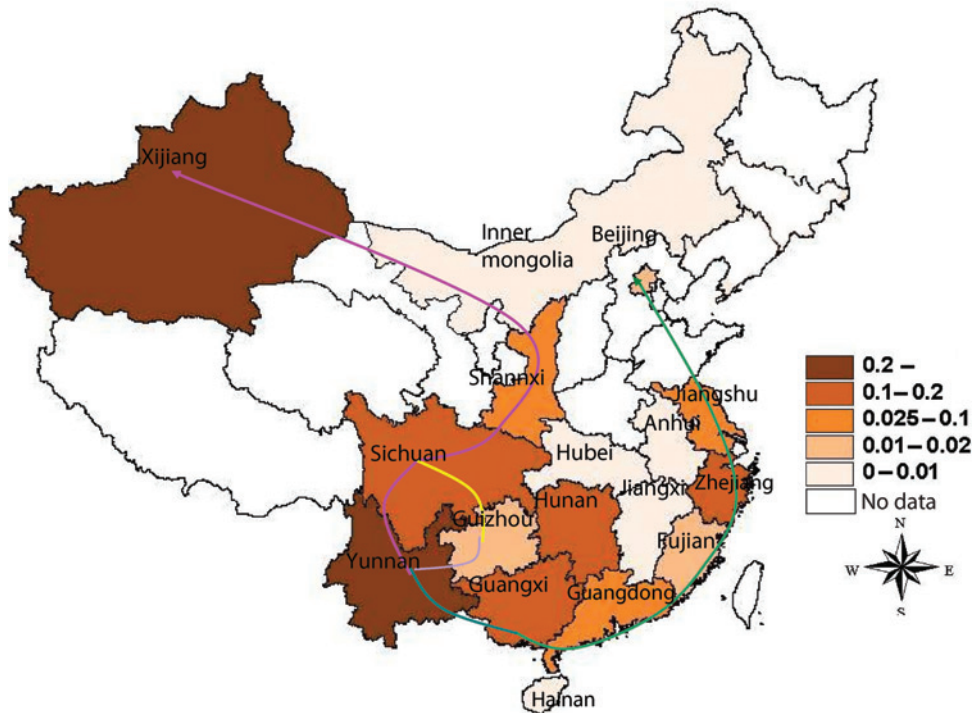


Figure 2 HIV infection among injection drug users in China and major heroin tracking routes into and within P.R. China (Sources: S G Sullivan, 2006¹⁸)

Estimation of HCV infection geographical distribution in drug users

The HCV prevalence rate was 66.7% and 18.30% among IDUs and non-IDUs, respectively. As can be seen in Table 3, the corresponding 95% CI of prevalence rate differed according to the route of drug administration. The HCV prevalence was significantly higher among IDUs (66.97%) than among non-IDUs (18.30%) ($P < 0.0001$).

Geographical variation was observed in HCV prevalence among drug users depending on the route of drug administration. Table 3 shows the detailed geographical distribution of HCV infection and 95% CI in IDUs and non-IDUs of China. Among 17 provinces with HCV infection data, the HCV infection prevalence in IDUs ranged from 11.43% in Shannxi to 90.77% in Hubei Province. HCV identification of 70% or more was found in the following areas: Guangxi (86.90%), Xinjiang (84.95%), Yunnan (83.33%), Hunan (76.31%) and Fujian (70.16%) (see Figure 3). Among non-IDUs, the HCV prevalence rate ranged from 0 in Anhui Province to 40% in Fujian Province.

Estimation of HIV-HCV co-infection in drug users

The literature shows that the overall prevalence of HIV and HCV co-infection was 6.45% in IDUs. In IDUs, the HIV and HCV co-infection was highest in Guangxi (15.23%), followed by Xinjiang (14.50%), Hunan Province (11.64%), Sichuan (8.48%) and Jiangsu (2.48%). However, the HIV-HCV co-infection was prevalent only in Jiangsu Province (0.43%) among non-IDUs.

DISCUSSION

This systematic review presents data of HIV, HCV infection and HIV and HCV co-infection detection rates among 15,565 Chinese drug users from 17 provinces and autonomous regions. The HIV prevalence rates were 12.55% in IDUs and 1.05% in non-IDUs, respectively, and the HCV prevalence rates were 66.97% and

18.30%, respectively. The overall HIV and HCV co-infection prevalence rate was 6.45% in IDUs. It should be noted that there was a publication bias in the papers reviewed; most studies of HIV and HCV in China until now have focused particularly on high-risk subpopulations in high-prevalence areas, which may perhaps overestimate the overall HIV and HCV infection at the national level. A global epidemiology of HIV among IDUs showed that the HIV prevalence rate was 12% among IDUs in China, which was consistent with our findings.⁵⁸ Hence, more related studies with a large geographical coverage need to be conducted in the future. The surveillance system has expanded rapidly; the national surveillance and sentinel sites were increased from 247 at the end of 2004 to 393 by the end of 2006 and the system will provide detailed information to government.¹⁰

These findings provide a descriptive and geographical distribution of HIV and HCV infection among drug users as determined by the route of administration. In IDUs, Yunnan province was found to have the highest rate of HIV prevalence (52.51%). This may be linked to the Province being an important transfer station for drug trafficking from nearby heroine-producing areas, primarily Myanmar, to other regions of China¹⁸ (Figure 2). In 1989, HIV-1 infection was detected for the first time among IDUs in the Ruili county of Yunnan, which shares a border with Myanmar.⁹ Xinjiang has the second highest prevalence of HIV infections and is located in closer proximity to the Golden Crescent region (primarily Afghanistan) but also receives trafficked heroin from Myanmar.^{15,18} In 1997, HIV was detected for the first time among a cluster of IDUs in Urumqi, the capital city of Xinjiang.¹⁵ Among all drug users, the HIV prevalence rates were 10% or more in Yunnan, Xinjiang, Guangxi, Sichuan and Hunan Provinces, with the number of identified HIV-positive cases as a result of IDU numbering over 10,000 in each province.¹⁰ Common determinants as to why these specific provinces have a high prevalence of HIV among drug users were variable but the contributing factors were as follows. (1) A greater proportion of IDUs among the wider drug-using community involved in high-risk behaviours including widespread sharing of injection equipment and infrequent use of condoms during sex. For example an investigation of IDUs from Yunnan

Table 3 HCV infection among drug users by province in China

Province	IDU			Non-IDU			All drug users		
	HCV (%)	95% CI (%)	Range (%)	HCV (%)	95% CI (%)	Range (%)	HCV (%)	95% CI (%)	Range (%)
Hubei	90.77	90.37–91.18	77.42–92.50	35.42	33.49–37.35	11.11–41.03	79.15	78.52–79.79	57.30–82.41
Guangxi	86.90	86.73–87.08	85.48–91.0	–	–	–	86.90	86.73–87.08	85.48–91.0
Xinjiang	84.95	84.02–85.88	64.20–100.0	38.10	38.10–38.10	38.10–38.10	82.76	81.81–83.70	64.20–100.0
Yunnan	83.33	82.96–83.71	79.66–86.08	37.93	37.93–37.93	37.93–37.93	75.45	74.36–76.53	21.52–62.81
Hunan	76.31	76.08–76.53	68.75–82.35	13.82	12.28–15.36	7.41–33.33	69.44	68.85–70.03	50.55–76.29
Fujian	70.16	70.08–70.24	68.12–78.39	40.00	39.45–40.55	27.56–48.19	61.09	61.08–61.10	60.58–61.51
Beijing	69.91	69.91–69.91	69.91–69.91	5.93	5.93–5.93	5.93–5.93	34.36	34.36–34.36	34.36–34.36
Inner Mongolia	67.51	67.51–67.51	67.51–67.51	10.2	10.20–10.20	10.20–10.20	47.54	47.54–47.54	47.54–47.54
Jiangxi	64.46	64.46–64.46	64.46–64.46	27.37	27.37–27.37	27.37–27.37	48.15	48.15–48.15	48.15–48.15
Sichuan	63.71	63.08–64.33	35.03–80.80	30.23	29.10–31.35	19.33–48.91	54.74	53.96–55.52	24.21–80.80
Anhui	57.14	57.14–57.14	57.14–57.14	0	–	–	25.26	25.26–25.26	25.26–25.26
Guangdong	53.34	51.20–55.48	13.07–93.26	20.91	19.37–22.44	4.95–48.75	44.63	43.07–46.18	11.05–85.09
Hainan	36.21	36.21–36.21	36.21–36.21	26.33	26.33–26.33	26.33–26.33	29.69	29.69–29.69	29.69–29.69
Jiangsu	35.51	35.06–35.96	31.70–49.13	4.96	4.90–5.01	3.96–5.92	18.81	18.74–18.88	17.25–21.05
Zhejiang	29.37	28.25–30.49	21.88–35.44	0.85	0.85–0.85	0.85–0.85	16.48	14.95–18.00	8.24–35.44
Guizhou	22.89	22.89–22.89	22.89–22.89	7.23	7.23–7.23	7.23–7.23	15.06	15.06–15.06	15.06–15.06
Shannxi	11.43	11.43–11.43	11.43–11.43	4.24	4.24–4.24	4.24–4.24	4.76	4.76–4.76	4.76–4.76
Total	66.97	66.55–67.39	11.43–100.0	18.30	17.85–18.75	0.85–48.75	51.71	51.29–52.13	4.76–100.0

IDU = injection drug user; Non-IDU = non-injection drug user; CI = confidence interval

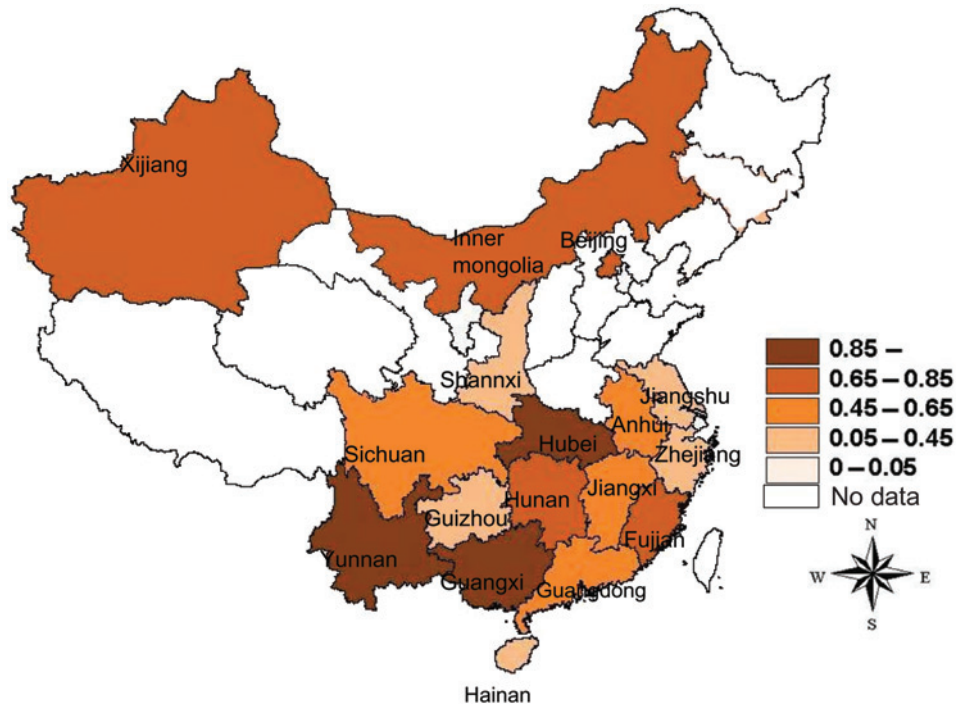


Figure 3 HCV infection among injection drug users in China

Province showed that 50.2% had a history of sharing contaminated needles.^{59,60} (2) Provinces or autonomous areas were located in close proximity to drug trafficking routes of Eastern Burma to north-western China that move towards Kunming City in Yunnan, then travelling north- and westwards, through Chengdu, capital of Sichuan Province, and across western China to Urumqi in Xinjiang Province, finally moving towards the Chinese and Kazakhstan border.⁶¹

HIV and HCV commonly share the same transmission routes. Like HIV, HCV can be transmitted by injection drug use, which is the predominant mode of HCV transmission in IDUs.⁷ Like HIV infection, HCV infection had considerable geographical variation among IDUs (Figure 3) since HCV and HIV share needle-sharing behaviours as a transmission route in this population. Many studies of co-infection were conducted among samples of HIV- rather than HCV-positive IDUs and the HIV-HCV co-infection in IDUs was detected only among drug users from Xinjiang, Sichuan, Guangxi, Hunan and Jiangsu provinces. There is a continuing need for further research with larger sample sizes to estimate the HIV and HCV co-infection prevalence among IDUs in China.

Xinjiang, Yunnan, Guangxi and Hunan provinces, which were located in or close to the drug trafficking routes of eastern Burma to north-western China, had high HIV, HCV infection and HIV-HCV co-infections.⁶¹ However, the profiles of HIV and HCV geographical distributions were not consistent and there was a low correlation between the respective prevalence rates in many of the locations reported (e.g. HIV prevalence was over 90% among IDUs in Hubei, while HCV prevalence was only 0.37%). Governments of provinces with a high HCV and a low HIV infection should take urgent steps to prevent HIV infection because these provinces have a high latent risk of progressing as an HIV epidemic area.

This review has methodological limitations, including the reliability of assays for HIV and HCV detection and the

limited geographical coverage. Although only the literatures with a detailed description of the methods and assays were included in this review to ensure accordance and comparability of the pooled data, it is difficult to ascertain the reliability and quality of estimates of the reliability and representativeness of geographical variation. However, we need to acknowledge the impact of the large gap in test kit standards and quality control for HIV and HCV testing on the results of this review. The publication bias was compounded by our focus on English and Chinese language literature, with English language studies being limited. Sentinel surveillance data of China show that the HIV infection rate among IDUs continues to increase;¹⁰ however, we could not adjust the prevalence because of the limited data in this review. The proportion of IDUs and non-IDUs had an effect on the pooled overall prevalence in all detected drug users. The different detection times in different provinces and autonomy regions represented an important confounding factor to achieve a merged comparable prevalence among Chinese drug users. The limited geography coverage and the limited sample size population was another challenge in this review: only 17 provinces and autonomy regions had HIV and HCV infection data among drug users, but data from 14 provinces and autonomy regions were not available. However, it was important to note that data from the 17 provinces examined account for the majority of the HIV and HCV infections among drug users.¹⁰ Infection estimates of greater geographical coverage, high quality and larger sample size studies would be necessary to provide a more accurate profile of HIV and HCV infection among Chinese drug users.

To better control the spread of HIV and HCV and to identify those in need of treatment, the government of China launched a national programme to actively seek out specific high-risk groups vulnerable to HIV infection.^{16,18} Moreover, in institutional settings, HIV testing is currently being conducted as part of a routine health check-up.¹⁵ The available findings

have emphasized that HIV and HCV infections represented a major adverse health consequence among drug users, resulting in a considerable health burden for China. The need to scale up and accelerate harm-reduction interventions to prevent HIV and HCV infections among IDUs was a priority. Harm-reduction interventions in China involved changing from only a response to episodes of and outbreaks of HIV and HCV to an HIV- and an HCV-preventative model. The likelihood of further epidemics of HIV and HCV infections among drug users in other parts of China was likely when following this strategic model. However, it does need to be acknowledged that, in recent years, the Chinese government has adopted an impressive strategy of implementing a range of harm-reduction approaches for drug users, including methadone maintenance treatment, needle-syringe programmes, outreach and increasing access to HIV testing. With increasing government support and ongoing advocacy to scale up harm-reduction responses, it was anticipated that an increasing number of drug users will be accessed and supplied with the means to minimize their vulnerability to HIV and HCV infections.¹⁷

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