

## Original Article



## Characteristics of the HIV/AIDS Epidemic in Women Aged 15-49 Years from 2005 to 2012 in China

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### Abstract

**Objective** To describe the characteristics of the HIV/AIDS epidemic in women aged 15-49 years in China.

**Methods** HIV/AIDS cases from 2005 to 2012 that fulfilled the inclusion and exclusion criteria were identified on the Chinese HIV/AIDS case reporting system. Descriptive and spatial analyses were performed.

**Results** A total of 103,559 female HIV/AIDS cases were included in our study. Based on the descriptive analysis, between 2005 and 2012, the proportion of heterosexually acquired HIV infection among women (15-49 years) increased rapidly from 35.8% to 87.4%. Approximately 60% of these cases were infected through non-marital heterosexual contact. Among older women (40-49 years), a slightly increasing trend was identified. The spatial analysis detected 'hot spots' in the Xinjiang, Yunnan, Sichuan, Guangxi, and Chongqing provinces. The epidemic trends in these areas were predominately driven by heterosexual transmission.

**Conclusion** Non-marital heterosexual contact is a very important factor in the HIV/AIDS epidemic in women aged 15-49 years, and the HIV infection rate in older women is increasing. Several epidemic hot spots were detected in northwestern and southwestern China. Efficient interventions are needed to control the spread of HIV/AIDS among women living in these areas.

**Key words:** AIDS; Women; Epidemiology; China

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### INTRODUCTION

According to the Joint United Nations Programme on HIV/AIDS (UNAIDS) 2014 GAP report, at the end of 2013, there were approximately 35 million (33.2-37.2) people living with HIV/AIDS (PLWHA) around the world. Of these, 16 million (15.2-16.9) were women aged 15

years and older<sup>[1]</sup>. A strong global consensus was reached to end the AIDS epidemic by 2030 based on the current existing tools<sup>[2]</sup>. Despite a low national HIV prevalence of 0.058% in China<sup>[3]</sup>, the country still has 89% of the PLWHA in East Asia as it has the largest population in the world<sup>[4]</sup>. In 2011, the number of PLWHA in China was estimated at 0.78 million; of which, 28.6% were women<sup>[3]</sup>. Two factors

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have contributed to women aged 15-49 years becoming the at-risk group for HIV/AIDS. Firstly, these women are sexually active and bear a critical responsibility in heterosexual transmission. Secondly, most women aged 15-49 years in China traditionally have one or more children, which leads to a high risk of mother-to-child transmission if the mother is HIV positive. Exploring the characteristics of the HIV/AIDS epidemic in this population will improve our understanding of disease distribution and enable recommendations to be made for disease control. However, there have been no systematic analyses of the epidemic characteristics with regard to this group in China to date.

The objectives of this study were to describe the epidemic characteristics of reported HIV/AIDS cases among women aged 15-49 years, and to determine the source of heterosexual transmission. Furthermore, spatial analysis was used to reveal spatial distribution patterns of HIV/AIDS infection in women aged 15-49, to detect potential clusters, and to assess the epidemic by region.

## METHODS AND MATERIALS

### *Data Collection*

The Chinese HIV/AIDS case reporting system (CRS) network was established in 1985 through which data are reported. According to the National Guideline for Detection of HIV/AIDS, HIV blood testing includes initial screening and confirmation testing<sup>[5]</sup>. Individuals showing a positive reaction in the confirmation tests are identified as infected with HIV. Individuals from the local Centers for Disease Control and Prevention (CDC) and medical institutions are responsible for reporting newly identified cases of HIV infection. A self-administered questionnaire survey is conducted to collect information on demographics and high-risk behaviors from infected individuals. The demographic data collected includes gender, marital status, ethnicity, educational attainment, residency, and occupation. The information collected on high-risk behaviors includes sharing syringes, non-marital sexual contact, homosexual behavior, and sexually transmitted diseases. Logic and duplicate checks are conducted at both local and national level to improve data quality.

### *Data Management*

All cases reported before June 2013 were

downloaded from the CRS. To meet our research purpose, specific inclusion and exclusion criteria were set. The inclusion criteria included date of report between 2005 and 2012, female, and aged 15-49 years. Cases where the birthdate was unknown, key information was lacking, or there were errors in logic were excluded. All identifying information was removed for privacy protection. Descriptive analyses were conducted on age, marital status, occupation, transmission route, disease type, and sample source using SPSS 19.0 software (IBM Inc., Armonk, NY, USA). In the heterosexual transmission group, another variable 'exposure' was included to determine the distribution of those infected through heterosexual transmission. Exposure was categorized as non-marital sexual contact, fixed sexual contact, and other. The geocode at city level was extracted to create an epidemic distribution map of reported HIV/AIDS cases in women aged 15-49 years for 2005-2012. In addition, the distribution of transmission route at provincial-level was presented in map format for the study period. A general autocorrelation analysis was performed to determine whether cases were clustered, and a local autocorrelation analysis was used to detect specific clusters. ArcGIS 10.2 software (ESRI Inc., Redlands, CA, USA) was used to create the epidemic distribution maps and to conduct the spatial analysis.

## RESULTS

### *Demographic Characteristics*

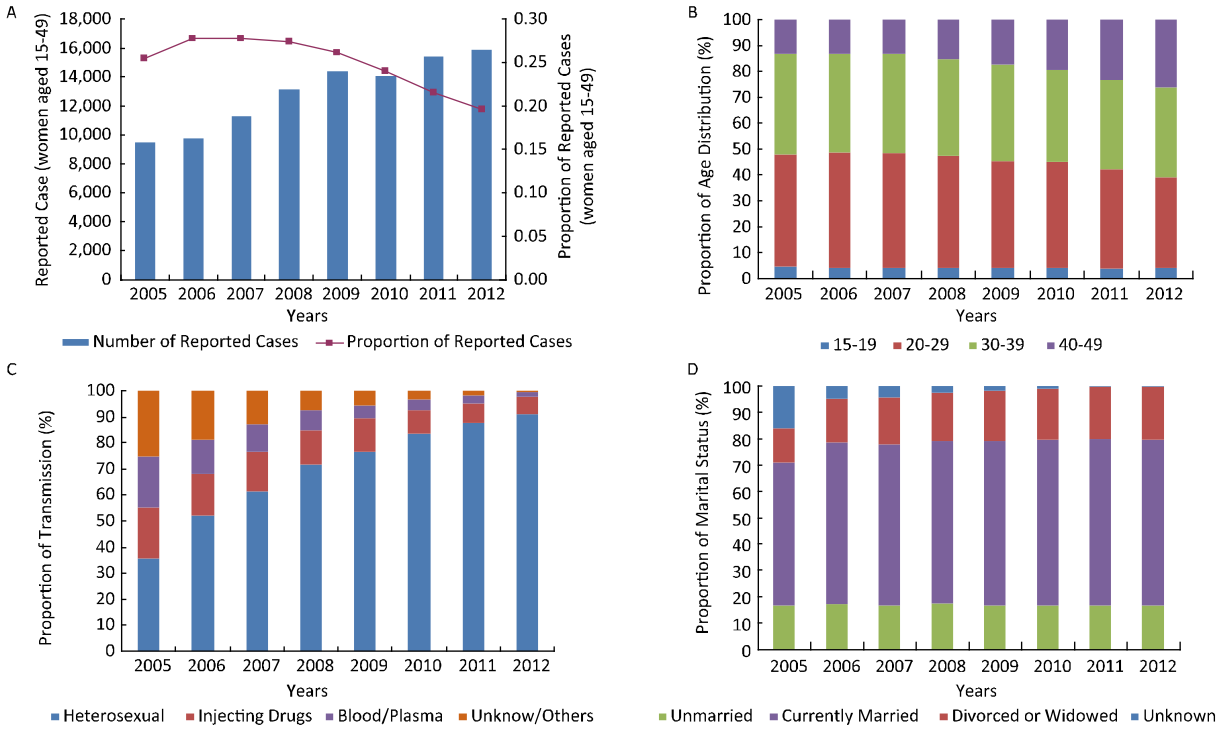
According to the CRS, a total of 427,534 PLWHA cases were reported between 2005 and 2012. Among which, 103,695 were women aged 15-49 years. Of these, 114 cases were excluded because of a lack of key information and a further 22 cases were excluded because of the presence of a logical error. Therefore, 103,559 cases were included in the final analysis.

Between 2005 and 2012, the number of cases of women infected with HIV/AIDS increased gradually, but the proportion of women among the overall PLWHA population reduced (Figure 1A). The majority of cases in women were observed in the 20-39 age groups, but the proportion of older women (40-49 years) affected increased over the study period (Figure 1B). Figure 1C and 1D show that heterosexual transmission among women increased rapidly over the study period from 25.8% to 87.4%, and that the majority of reported cases were in married women.

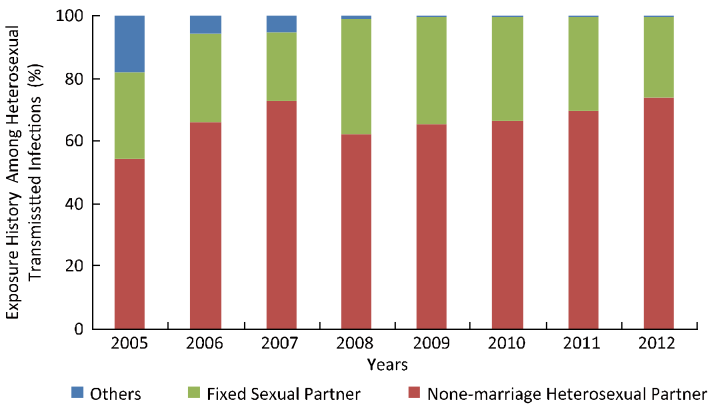
Analysis of the transmission route distribution among older women (40-49 years) showed that the percentage of heterosexual contact within this population increased from 28% in 2005 to 90% in 2012.

As heterosexual transmission accounted for the

largest proportion of cases among all transmission routes, a sub-analysis for exposure history was performed. In this subgroup, infection was mainly transmitted through non-marital heterosexual contact, which reached 70% of all heterosexual transmission cases over the study period (Figure 2).



**Figure 1.** A, Number and proportion; B, Age distribution; C, Transmission route distribution; D, Marital status distribution of the cases of HIV/AIDS infection reported in women aged 15-49 years from 2005-2012.



**Figure 2.** Exposure history in women (15-49 years) with HIV/AIDS infection transmitted through heterosexual contact from 2005-2012.

### Spatial Analysis

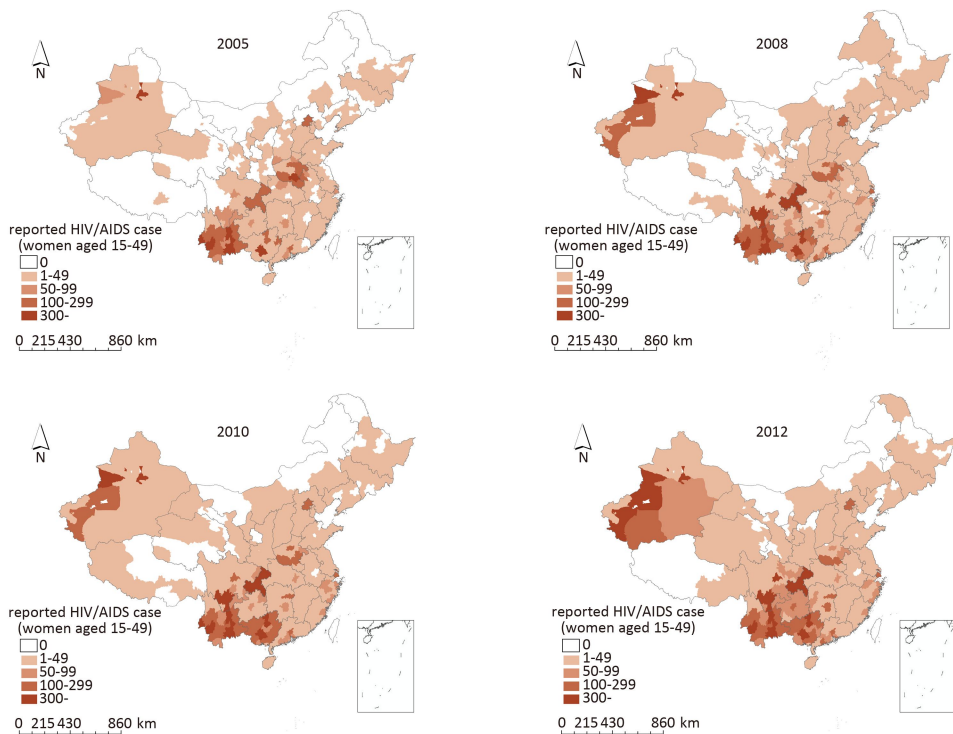
The geographical distribution map indicated that the number of cities reporting cases of HIV/AIDS infection in women aged 15-49 years increased from 263 in 2005 to 315 in 2012 (Figure 3). Reported infections were concentrated in specific provinces. In 2005, 75% of cases were distributed between five provinces (Yunnan, Henan, Guangxi, Guangdong, and Xinjiang). In 2012, the Yunnan, Sichuan, Xinjiang, Guangxi, and Guangdong provinces accounted for as many as 68% of cases. Figure 4 shows the provincial-level transmission route distribution maps. In 2005, a high number of reported HIV/AIDS cases were observed in the Henan, Yunnan, and Guangxi provinces with different transmission modes. Blood/plasma transmission was dominant in Henan, with heterosexual contact dominating in Yunnan and Guangxi. Additionally, infection through injecting drugs accounted for a large proportion of the reported cases in Yunnan. In 2012, the reported cases of HIV/AIDS infection were mostly transmitted through heterosexual contact nationwide, with the exception of injecting drugs in Sichuan province.

General and local spatial autocorrelation tests were conducted to test clustering in each year from 2005-2012. Figure 5 shows the results of the local

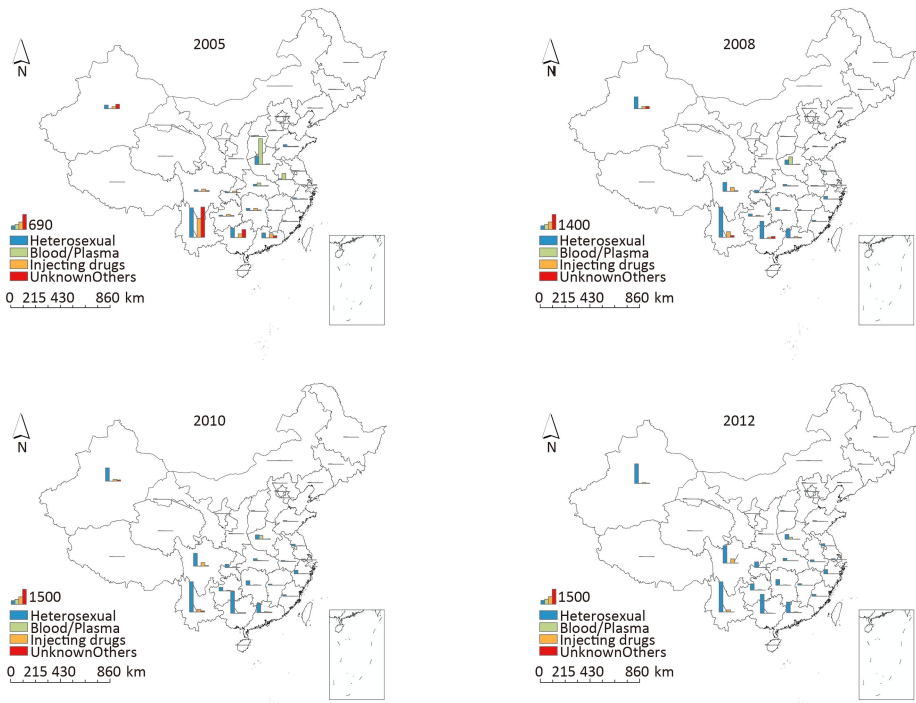
spatial autocorrelation analysis to determine hot spots of reported HIV/AIDS cases among women aged 15-49 years. In 2005, hot spots were located in Urumchi, Zhumadian, Liuzhou, Nanning, Dehong Autonomous Prefecture, Honghe Autonomous Prefecture, and Kunming. In later years, Zhumadian was no longer a hot spot, but new hot spots were detected in Chongqing, Chengdu, Liangshan Autonomous Prefecture, Guangzhou, Kashgar, Aksu, and Ili.

### DISCUSSION

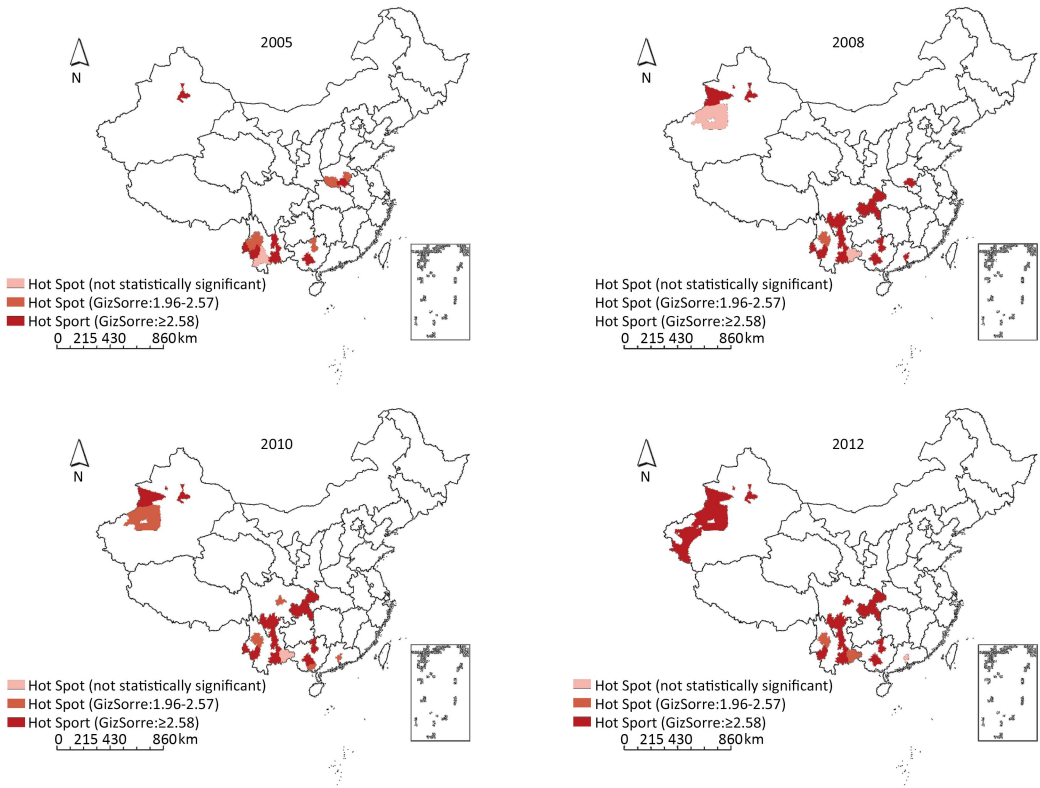
Our study included all cases of HIV/AIDS infection in women aged 15-49 years reported between 2005 and 2012 in mainland China ( $N=103,559$ ). This is the first report on the epidemic characteristics of this population, and maps were created to present the geographical distribution and spatial clusters of infection. Over the study period, the incidence rate of HIV/AIDS infection in older women (40-49 years old) increased from 13.5% to 26.3%. Newly reported cases in women were mainly driven by heterosexual transmission, among which the majority were infected through non-marital heterosexual contact. Spatial analysis detected potential clusters located in the cities of Xinjiang, Yunnan, and Guangxi provinces.



**Figure 3.** Geographical distribution of the cases of HIV/AIDS infection in women aged 15-49 years reported in 2005, 2008, 2010, and 2012 in China.



**Figure 4.** Transmission route distribution maps of the cases of HIV/AIDS infection in women aged 15-49 years at provincial-level reported in 2005, 2008, 2010, and 2012 in China.



**Figure 5.** Hot spots of cases of HIV/AIDS infection in women aged 15-49 years reported in 2005, 2008, 2010, and 2012 in China.

A global increase in the number of HIV/AIDS cases reported among older people has been well documented<sup>[6-7]</sup>, and several domestic studies have reported an emerging challenge of the rapid spread of HIV infection among older groups<sup>[8-9]</sup>. In this study, we observed a similar increasing trend, which was particularly evident in older women (40-49 years old). Heterosexual contact was identified as the main mode of transmission in this population, which might reflect the findings of a previous study that demonstrated that HIV infections among female sex workers (FSWs) were disproportionately high in those over 40 years old<sup>[10]</sup>. This could be related to the finding that older FSWs are more frequently associated with inconsistent and ineffective condom use<sup>[11]</sup>. Other causes of the rising incidence of HIV/AIDS infection in this group remain unclear and call for more research.

The increasing proportion of cases transmitted by heterosexual contact in our study population is consistent with all reported HIV/AIDS cases<sup>[3]</sup>. Firstly, the sexual liberation in China could have prompted the increase in the proportion of cases involving heterosexual transmission. Before the reform and opening-up policy, traditional Chinese values held that marital sex was only for the purpose of reproduction, with premarital and extramarital sex regarded as shameful<sup>[12]</sup>. With the introduction of the 'Open Door Policy' following fast economic development, Chinese society underwent a tremendous sexual revolution<sup>[13]</sup>. The old family structure with the man as the breadwinner and the woman raising the children gradually changed, and women were free from being tools of reproduction. At this point, sex was for pleasure<sup>[14]</sup>. Sexual liberation was evident in a rapid increase in new sexually transmitted infections (STIs)<sup>[15]</sup>, and wide acceptance of premarital sex<sup>[16]</sup>. There has been a lot of research on sexuality in women in China over the past 30 years<sup>[17]</sup>. Huang et al. analyzed the prevalence of multiple sexual partnerships among adult women in China and found a dramatic increase from 8.1% in 2000 to 29.6% in 2006<sup>[14]</sup>. Secondly, it has been reported that unsafe sexual behavior is still common and that condom use remains low in China<sup>[18-20]</sup>. A qualitative investigation conducted among FSWs in Guangzhou demonstrated three key factors that influenced condom use: excessive trust in clients, stereotypes, and assumptions about customers and money motivation<sup>[21]</sup>. In addition, studies have found that sex without a condom is

much more frequent with non-commercial and regular partners<sup>[22-23]</sup>. Thirdly, men who have sex with both men and women have contributed most to the spread of HIV. Consistent with other countries around the world, men who have sex with men (MSM) became the key group associated with the spread of HIV<sup>[24]</sup>, and according to sentinel surveillance results, the HIV prevalence among MSM was as high as 6.3% in 2011<sup>[25]</sup>. With such a high HIV prevalence rate, men who have sex with men and women act as bridging groups that spread HIV to the general population. A study found that between 2010 and 2012, approximately 25% of MSM had also had sex with women within the past 6 months, in which only 25% had consistently used condoms<sup>[26]</sup>. Furthermore, nearly 35% of MSM expressed the intention to get married with a woman in the future because of the pressure from both society and family<sup>[27]</sup>. Bisexuality is a potential risk factor for HIV spread and more in-depth studies are required to assess the influence of this mode of transmission. Fourthly, the control of the spread of HIV infection through injecting drugs and blood/plasma, combined with a decline in unknown transmission, could partially explain the increasing proportion of cases associated with heterosexual transmission. There have been two important outbreaks of HIV infection in China. The first was in injecting drug users in Yunnan<sup>[28]</sup>, and the second was from commercial blood/plasma donors in Henan<sup>[29]</sup>. Great efforts through national interventions, such as methadone maintenance treatment (MMT), needle exchange programs, and blood management regulations, were made to prevent the spread of HIV through injecting drugs and blood/plasma donations<sup>[30-32]</sup>. The proportion of cases of unknown transmission was reduced substantially as a direct consequence of the development of China's HIV/AIDS CRS<sup>[33]</sup>.

A subgroup analysis found that infections associated with heterosexual transmission were mainly contracted through non-marital contact. This may be associated with the changes seen in social structure. As women strive for equality with men in society, and society vigorously promotes independence and self-improvement for women, their attitudes toward sex have become more open. This poses a great challenge for the prevention and control of HIV in China.

Clusters of reported cases of HIV/AIDS infection in women were mainly located in southwestern and northwestern cities, which is consistent with the

overall epidemic distribution in China. The map of the number of HIV/AIDS infections shows a decreasing trend from the center located in Yunnan province. The transmission route distribution maps show that heterosexual transmission dominated almost all provinces, with a considerable proportion of cases in Sichuan and Yunnan due to injecting drugs. Comprehensive interventions to target the spread of HIV *via* heterosexual transmission should be implemented in Xinjiang, Yunnan, Guangxi, Guangdong, and Sichuan.

Despite the strengths associated with the large sample size, long study period, and effective use of geographical information to code cases, our study has some limitations. Firstly, our study was strictly based on case reporting data which is sensitive to policy, intervention, and testing. Each of these potential factors might influence the case reporting sensitivity. For example, regions with strong policy support tend to put more effort into discovering potential patients than those with limited resources. Secondly, our study included women from both the general population and FSWs, and the risks of infection between the two groups could vary substantially. Since we were not able to distinguish between the two groups, a more specific description of the target general female population was not available.

In conclusion, between 2005 and 2012, the HIV/AIDS epidemic among women aged 15-49 years was mainly driven by heterosexual transmission, specifically by non-marital heterosexual contact. Moreover, an increasing proportion of the infections were identified in older women. Clusters were detected in Yunnan, Xinjiang, Guangxi, Guangdong, and Sichuan; therefore, efficient interventions should be implemented in these regions to control the spread of HIV among women.

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