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Research Article

Epidemiological Characteristics Of HIV Antibody Screening And 1386 Cases Of HIV-Infected In Urban Areas Of Agricultural-Pastoral Region In Northeastern China: A 20-Year Cross-Sectional Study.

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Abstract

Objective: This study analyzed the epidemiological characteristics of HIV-Positive Person in Chifeng, Inner Mongolia, China, over a 20-year period. It includes the detection of transmission routes, time trends, transmission routes and population characteristics. This study provides a reference for the formulation of targeted prevention and control measures for AIDS in the future.

Method: The data of HIV antibody test module and HIV-Infected individuals in Chifeng, Inner Mongolia, China from 2005 to 2024 were collected from 354 medical and health institutions to the Chinese Disease Prevention and Control Information System.

Results: A total of 7,989,346 people were screened for HIV antibody in Chifeng, Inner Mongolia, and 1386 cases of HIV-Infected were detected, with a screening positivity rate of 17.35/100 000. Primary case detection methods included patient testing in medical institutions,preoperative testing and Sexually Transmitted Disease clinic (STD clinic) testing. Positivity rates varied significantly across detection methods. The number of HIV infections showed an annual increase. All districts in Chifeng were reported to have HIV infection, and the number of cases in J and K districts accounted for 56.42%. The infection rate varied among districts. Male accounted for 90.76% of the HIV-Infected individuals, and the infection rate was different between males and females. There were ethnic differences in the infection rates, mainly in Han and Mongolian. The infection rate was different among the age groups, with an average age of 36.58±12.63 years. The main route of transmission was sexual transmission, and the proportion of heterosexual transmission was on the rise in the past decade.

Conclusion: The main ways of HIV diagnosis were patient testing in medical institutions, preoperative testing and STD clinic testing. Male cases were more than female cases, and the proportion of young and middle-aged cases was high. Sexual transmission was the main transmission route, and the number of Mongolian cases increased year by year.

Keywords : Inner Mongolia Autonomous Region; Chifeng; HIV/AIDS; Case detection methods; Characteristics of epidemics.

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INTRODUCTION

Acquired Immune Deficiency Syndrome (AIDS) is a major infectious disease that endangers human health. Human Immunodeficiency Virus (HIV) destroys the human immune system and causes the human body to lose the ability to resist various diseases. At present, there are no cure drugs and effective vaccines [1,2,3,4]. By December 31, 2024, a total of 1,355,017 people living with HIV and 491,437 deaths have been reported in China [5]. Inner Mongolia is located in the northern border of the People's Republic of China, bordering Mongolia and the Russian Federation, with a total area of 1.183 million square kilometers. It is one of the five ethnic minority autonomous regions in China and belongs to the low epidemic area of AIDS. Chifeng, located in the southeast of Inner Mongolia Autonomous Region, is the most populous city in the Inner Mongolia Autonomous Region[6], with a permanent population of about 4.036 million, mostly from rural areas. It is close to the capital Beijing and has relatively developed transportation. In recent years, there have been more reports on the epidemic characteristics and epidemic situation of AIDS in Yunnan Province, Guizhou Province and Guangxi Zhuang Autonomous Region of China [7,8,9], but there are few reports on the epidemic characteristics of AIDS cases in Inner Mongolia. To study the discovery route, time trend, population characteristics and transmission route of HIV infection in Chifeng, Inner Mongolia, and to identify the risk of transmission. This study analyzed the HIV antibody screening data of Chifeng in the past 20 years and the characteristics of 1386 HIV-Infected people, so as to provide reference for the development of targeted prevention and control measures in the future.

METHOD

Data

China Information System for Disease Control and Prevention: China Information System for Disease Control and Prevention is a national information system built by the Chinese Center for Disease Control and Prevention for medical and health users. The system focuses on the reporting of infectious diseases and public health emergencies. At present, it has covered all medical and health institutions in the country.

HIV antibody testing module: Module used to collect HIV antibody screening data in China Information System for Disease control and Prevention, which can systematically collect and analyze dynamic data of HIV antibody screening. All medical institutions conducting HIV antibody testing in Chifeng were required to report the screening information through the module.

HIV infection case card: It is a record reported by medical institutions through the Chinese Disease Prevention and Control Information System after the diagnosis of HIV infection in accordance with the health industry standard of the People's Republic of China (WS 293-2019). The card records the key information of the infected person in detail, such as gender, age, diagnosis, etc., and is mainly used for monitoring and analyzing the AIDS epidemic.

System management and Security: The users of China Disease Prevention and Control information System must pass the approval of the unit, training, and user record, and issue a digital certificate to be qualified to log in to the China Disease prevention and control information system. Medical institutions and centers for disease control and prevention report users must pass their own digital certificate to log in to the system, which ensures the data integrity and security.

The Center for Disease Control and Prevention (CDC) is a public welfare institution organized by the Chinese government to implement technical management and services for disease control and prevention and public health. Its main responsibilities include disease prevention and control, emergency response to public health emergencies, monitoring and intervention of health hazards, laboratory testing and evaluation, health education and health promotion, etc.

The screening data were collected from 354 medical and health institutions in Chifeng, Inner Mongolia, which were reported to the HIV antibody test module of the Chinese Disease Prevention and Control Information system and the screening positive HIV case cards. Demographic data were collected from Chifeng Statistics Bureau. Geographic information related data (mainly map information) came from the standard map service system of the National Administration of Surveying, Mapping and Geographic Information.

Statistical Analysis

The screening data of 354 medical and health institutions in Chifeng city, Inner Mongolia from 2005 to 2024, reported to the HIV antibody test module of the Chinese Disease Prevention and Control Information System, and the case cards of screened positive HIV-Infected were collected. Data cleaning and validation were performed in Excel 2010 prior to analysis.

Descriptive analysis was conducted on the discovery route, time trend, population characteristics and transmission route of HIV-Infected. ArcGIS (Arc Geographic Information System) was used to draw maps. SPSS 26.0 (Statistical Product and Service Solutions, SPSS) 26.0 was used for statistical analysis, and $P < 0.05$ was considered statistically significant.

RESULTS

Results of HIV antibody screening

From 2005 to 2024, a total of 7,989,346 people were screened for HIV antibody, and 1386 HIV-Infected were screened, with a screening positivity rate of 17.35/100 000. The positivity rate from high to low was as follows: testing by spouses or sexual partners of positive cases (4562.04/100 000), STD clinic testing (257.48/100 000), voluntary counseling testing (157.21/100 000), and there was a significant difference in the positivity rate of different screening methods (χ^2=11621.409, P <0.001). The number of cases detected by other medical institutions was the largest, 392 cases (28.28%), followed by 237 cases (17.10%) detected before surgery and 231 cases (16.67%) detected in sexually transmitted disease clinics, as shown in **Table 1**.

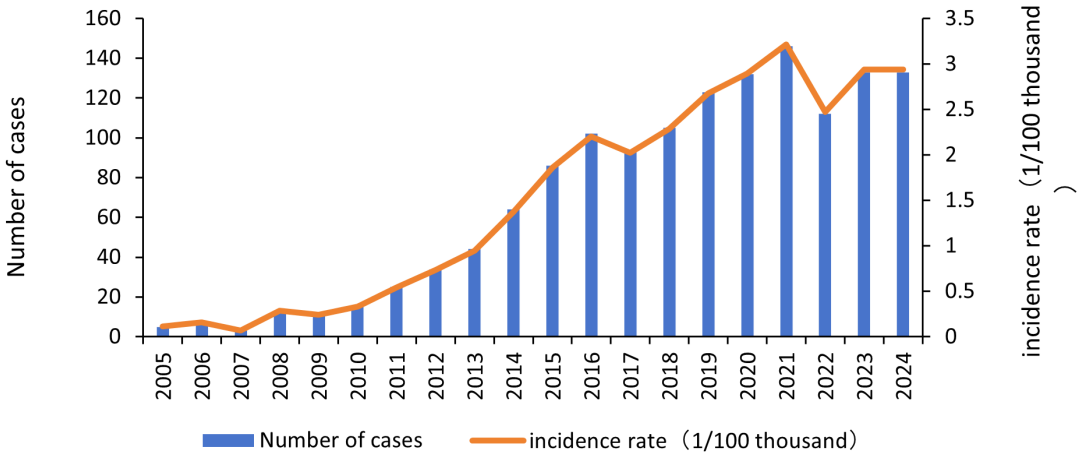
Table 1. Statistics of routes of discovery of HIV infection in Chifeng, Inner Mongolia, China, 2005-2024.

Case detection	Number of HIV antibody screening (n)	Number of HIV-Infected individuals (n)	positivity rate (100 000)	χ^2	P
Preoperative testing	2818824	237	8.41	11621.409	<0.001
Blood transfusion and blood product testing	275573	10	3.63		
STD Clinic Testing	89715	231	257.48		
Other patient testing	2161032	392	18.14		
Premarital examination	230414	26	11.28		
Prenatal examination	493135	5	1.01		
Voluntary Testing	144395	227	157.21		
The spouses or sexual partners of the positive cases were tested	548	25	4562.04		
Testing of blood donors	1472453	98	6.66		
Monitoring site testing	101807	31	30.45		
Other	201450	104	51.63		

Characteristics of time distribution

The first HIV-Infected was detected in 2005, and the first homosexual infection was detected in 2008, and the number of cases reached the peak (146 cases) in 2021. The results of Chi-square trend test showed that the number of HIV-Infected was increasing overall (χtrend ^{2}=747.387, P < 0.001), as shown in **Figure 1**.

Figure 1. Temporal distribution of HIV-Infected in Chifeng, Inner Mongolia, China, 2005-2024



Population characteristics

There were 1258 males (90.76%) and 128 females (9.24%), with a male to female ratio of 9.83:1. The infection rate of males was higher than that of females, and there was a gender difference in the infection rate (χ^2=870.881, P < 0.001). There were 1109 cases of Han (80.02%), 215 cases of Mongolian (15.51%), and 62 cases of other ethnic groups (4.47%), and there were differences in the infection rates among ethnic groups (χ^2=32.519, P < 0.001). The oldest was 87 years old and the youngest was 2 months old, with an average age of 36.58±12.63 years. There was a significant difference in the infection rate between ages (χ^2=901.324, P < 0.001). 388 cases (27.99%) were farmers and herdsmen, 344 cases (24.82%) were unemployed; 619 cases (44.66%) were unmarried and 604 cases (43.58%) were married or had spouses. There were 754 cases (54.40%) with high school or above education and 462 cases (33.33%) with junior high school education, as shown in **Table 2**.

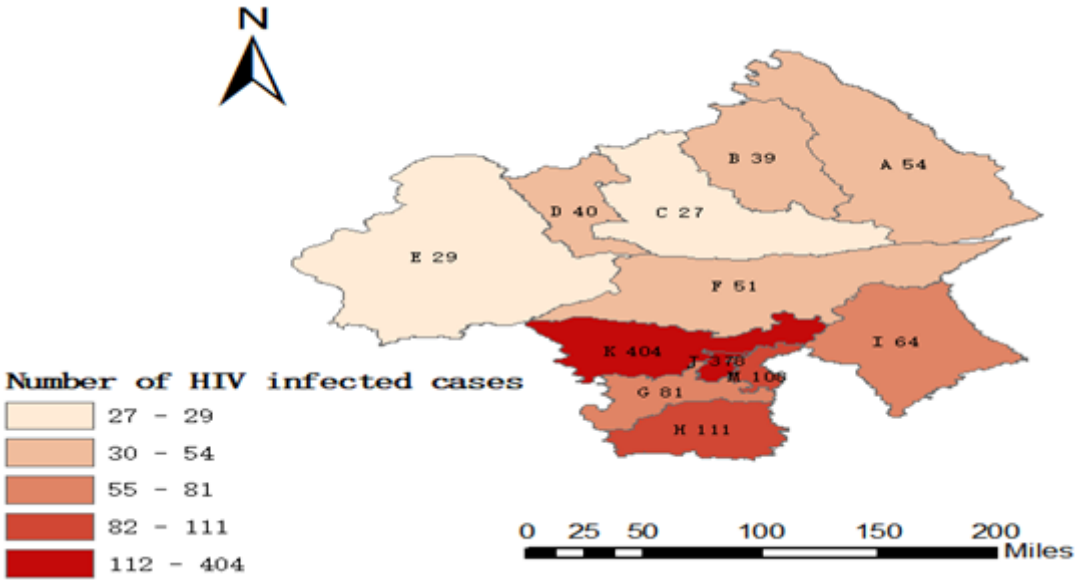
Table 2. Characteristics and distribution of HIV-Infected in Chifeng, Inner Mongolia, China, 2005-2024

	Number of cases	Infection rate (1/100000)	χ^2	*P*
District			1205.815	<0.001
J District	378	109.21		
M District	108	35.6		
K District	404	64.47		
A District	54	18.86		
B District	39	11.73		
C District	27	15.21		
D District	40	18.13		
E District	29	12.1		
F District	51	10.99		
G District	81	23.82		
H District	111	18.56		
I District	64	10.85		
Gender				
Male	1258	54.36	870.881	<0.001
Female	128	5.79		
Nationality				
Mongolian nationality	215	21.76	32.519	<0.001
Han nationality	1109	33.12		
Other	62	32.94		
Age				
0-19	78	8.66	901.324	<0.001
20-49	1060	56.29		
>50	248	18.68		
Occupations				
unemployed	344	-	-	-
Business Services	213	-		
Other or unknown	441	-		
Marriage				
Married or have a spouse	604	-	-	-
unmarried	619	-		
Divorced or widowed	163	-		
Education				
Primary school or below	170	-	-	-
Junior high school	462	-		
High school or above	754	-		

Regional characteristics

All districts in Chifeng had reported the cases, K district reported the largest number of cases (404 cases, 29.15%), followed by J district (378 cases, 27.27%), and the number of cases reported by J and K districts accounted for 56.42%. J district had the highest HIV-Infected rate (109.21/100 000). Chi-square test showed that there were differences in the infection rate among the districts (χ^2=1205.815,P < 0.001), as shown in Table 2 and **Figure 2**.

Figure 2. Regional distribution of HIV-Infected individuals in Chifeng, Inner Mongolia, China, 2005-2024



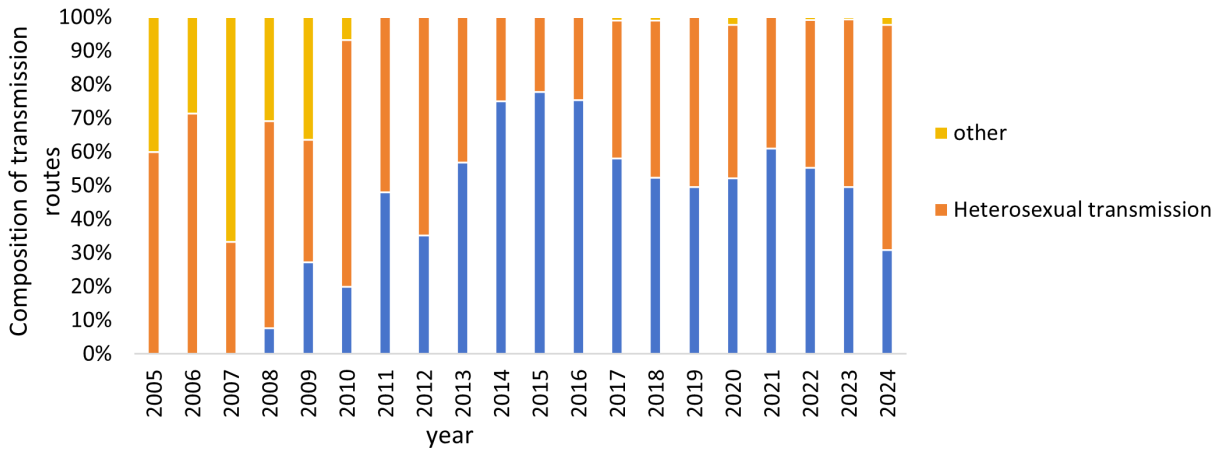
Characteristics of the distribution of sexual transmission routes

Sexual transmission was the main transmission route of AIDS (1361 cases), and other routes (25 cases, 1.80%). Among the sexual transmission cases, 745 (54.74%) were Male-to-male sexual transmission and 616 (45.26%) were heterosexual transmission. The proportion of Male-to-male sexual transmission decreased from 77.91% in 2015 to 31.54% in 2024, while the proportion of heterosexual transmission increased from 22.09% in 2015 to 68.46% in 2024. Chi-square trend test showed that the proportion of Male-to-male sexual transmission showed a downward trend in the past decade, while the proportion of heterosexual transmission showed an upward trend (χ^2=5.577,P=0.018), as shown in **Table 3** and **Figure 3**.

Table 3. Trends of sexual transmission routes among HIV-Infected individuals in Chifeng, Inner Mongolia, China, 2005-2024

Year	Male-to-Male sexual transmission (%)	Heterosexual transmission (%)	χ^2 trends	*P*
2005-2008	1(5.56)	17(94.44)	5.577	0.018
2009	3(42.86)	4(57.14)		
2010	3(21.43)	11(78.57)		
2011	12(48.00)	13(52.00)		
2012	12(35.29)	22(64.71)		
2013	25(56.82)	19(43.18)		
2014	48(75.0)	16(25.0)		
2015	67(77.91)	19(22.09)		
2016	77(75.49)	25(24.51)		
2017	54(58.70)	38(41.30)		
2018	55(52.88)	49(47.12)		
2019	61(49.59)	62(50.41)		
2020	69(53.49)	60(46.51)		
2021	89(60.96)	57(39.04)		
2022	62(55.86)	49(44.14)		
2023	66(50.00)	66(50.00)		
2024	41(31.54)	89(68.46)		

Figure 3. Constituent ratios of transmission routes among HIV-Infected individuals in Chifeng, Inner Mongolia, China, 2005-2024.



DISCUSSION

The infection rate of the whole population in Chifeng was 30.63/100 000, which was lower than the HIV infection rate of 96.21/100 000 in China [5], and it was at a low epidemic level. However, the infection rate of specific population was high, especially the positivity rate of spouses or sexual partners was 4562.04/100 000, which was higher than other ways, suggesting that the risk of family transmission and sexual partners transmission was higher. The detection methods of HIV/AIDS cases were mainly detected by other patients in medical institutions, preoperative testing and STD clinic testing, suggesting that medical institutions testing plays an important role in AIDS prevention and control and is an important way to find AIDS cases.

The increasing trend of cases was similar to the overall epidemic situation of AIDS in some areas [10,11]. In China, medical institutions simultaneously test AIDS, syphilis, hepatitis C and hepatitis B before surgery, prenatal and microscopic examinations, and STD clinic patients must be tested for AIDS, which makes the number of HIV antibody tests continue to increase, and the national HIV antibody tests will reach 410 million by 2023 [12].

In the past three years, about 600 000 people were tested for HIV antibody every year in Chifeng. With the expansion of the testing scope and the improvement of residents' active awareness of testing, more and more HIV-Infected people were tested. After 2008, increased HIV transmission among men who have sex with men (MSM) may have contributed, which may have contributed to the increase in the number of HIV-Infected. At present, the number of cases, although at a high level, has not shown an increasing trend for three consecutive years.

In terms of regional distribution, cases were reported in all districts of Chifeng. J and K districts with the highest number of cases and infection rate were the economic centers of Chifeng, with convenient transportation and developed economy. The dense population, large mobility, and rich social activities may increase the chance of HIV transmission. From the perspective of population distribution, the ratio of male to female was 9.83:1, which was higher than the level of 2.6:1 in China, and the infection rate of males was higher than that of females, which was consistent with the research results in some areas at home and abroad [13,14,15]. Especially among men who have sex with men, the infection rate is relatively prominent [16], which is closely related to the sexual behavior characteristics of this group such as multiple sexual partners and poor awareness of protection [17]. The infection rate of young and middle-aged people aged 20-49 years old is high, which is similar to the results of Prof.Du.J's study[18], which may be related to the characteristics of high sexual activity and diverse social ways of people in this age group. In recent years, the number of sexually transmitted infections in the elderly has increased more than in the past, and the infection in the elderly cannot be ignored [19].

From the point of view of transmission routes, the transmission routes of HIV-Infected people in Chifeng are consistent with the main transmission routes in China [5,20]. In the past decade, the proportion of Male-to-male sexual transmission has gradually decreased, while the proportion of heterosexual transmission has gradually increased, which is similar to the research results of Prof. Zhang's study [21]. Heterosexual transmission routes included spousal/steady partners, commercial sex work, and casual partnerships. It is necessary to strengthen the notification of sexual partners and follow-up testing for households with single HIV-Infected. In conclusion, the AIDS epidemic in Chifeng is still at a low epidemic level, but the change of transmission routes needs to be paid more attention, and the infection rate of specific high-risk groups cannot be ignored. Targeted health education should be carried out among the young and middle-aged groups, the elderly in the community, and households with

single HIV-Infected to popularize AIDS prevention knowledge, promote the use of condoms, and improve the awareness of disease prevention. Encourage medical institutions to carry out HIV antibody testing in anorectal clinics and digestive clinics, expand the scope of testing combined with clinical symptoms of AIDS, strengthen inter-departmental cooperation, and implement the joint prevention and control mechanism. Premarital testing is recommended to avoid transmission between couples.

Competing Interest

The authors declare that the research was conducted in the any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

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NA.

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