

The Clinical Characteristics and Incidence of Pulmonary Tuberculosis of 7632 HIV Patients in Yunnan Province from 2005 to 2017

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ABSTRACT

Objective: To analyze the age and gender distribution characteristics of 7,632 HIV/AIDS patients at the onset of HIV infection-related high-risk intravenous drug abuse and sexual contact in Yunnan province. **Methods:** Data were collected from the database of Chinese Medicine Treatment of AIDS Pilot Project in Yunnan province. Gender, age and demographics of HIV/AIDS patients were analyzed. **Results:** The patients were almost in relatively high educational background. The number of male intravenous drug users (12.90%) was more than female, and the earliest average age was 10-14 years. The percentages of men in 10-19 years and 35-59 years were more than that of women. No obvious difference was found in heterosexual sexual contact in both men (48.11%) and women (51.89%), and the earliest ages was 15-19 years in males and 10-14 years in females. The percentage of males at 10-34 years old was less than that of females, just opposite to the age of 35-85 years. Homosexual contact was more in males (92.73%) than that in females (7.27%). The earliest homosexual sexual contact associated with HIV infection was 15-19 years in males and 25-29 years in females. Among 128 AIDS patients with pulmonary tuberculosis infection, intravenous drug abuse accounted for the highest proportion (76.56%) of the three high-risk behaviors related to HIV infection. **Conclusions:** Reducing risk behaviors and preventing intravenous drug abuse could be effective in preventing AIDS. Compared with other high-risk behaviors, patients with intravenous drug use and AIDS are at greater risk of contracting tuberculosis.

1. Introduction

Yunnan Province is an AIDS epidemic area in China^[1]. Yunnan is located near the Myanmar, Laos and Vietnam

borders, where the AIDS epidemic currently spreads rapidly and is very serious. It is a major point of drug entry from the "Golden Triangle" and is used for major drug trafficking routes. Yunnan has numerous minority popu-

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lations with unique cultures and health habits. Moreover, their cultural health quality and self-protection awareness are relatively poor, leading to intravenous drug abuse and sexual contact as main routes of HIV infection [2-5]. The percentage of patients with HIV infection-related high-risk intravenous drug abuse and sexual contact varies with age and gender. Needle or syringe sharing is common among people who inject drugs, which leads to HIV and other blood-borne diseases transmission [6]. Men who have sex with men (MSM) and heterosexuals are the populations with the fastest growing HIV infection rates in China [7], which indicates that reducing unhealthy sexual activity should be put forward as a priority. Pulmonary tuberculosis is a common chronic infectious disease and a common complication of AIDS patients. Studies have found that tuberculosis in the world is related to AIDS, and it is still on a gradual upward trend [8]. For AIDS patients with pulmonary tuberculosis, dual infection will cause the disease to develop rapidly and worsen, and then lead to death [9].

In the present study, we analysed the age and gender distribution characteristics of 7,632 HIV/AIDS patients at the onset of HIV infection-related high-risk intravenous drug abuse and sexual contact in Yunnan Province between September 2005 and October 2017, and the incidence of tuberculosis in different high-risk behaviors, providing a scientific basis for future specifically planned safety education and management programs, for improvement of the prevention and control measures of AIDS, and for the reduction of the associated morbidity and mortality.

2. Materials and Methods

Data source

Data were obtained from a special version of the ClinResearch data management system created for the Chinese Medicine Treatment of AIDS Pilot Project; ClinResearch is an Electronic Data Capture (EDC) software system hosted and developed by the Academy of Chinese Medical Sciences. This system records patients' basic information before treatment, including gender, age, ethnicity, marital status, educational background, route of infection, HIV antibody diagnostic report, and age at onset of infection-related high-risk behaviour, and dynamically records patients' treatment situation.

Study design

Data cleaning and quality verification were conducted on the ClinResearch database in Yunnan Province. From September 2005 to October 2017, all effective cases who

consulted or were treated at any of the 44 treatment points in the nine prefectures and cities in Yunnan Province (including Dehong Prefecture, Honghe Prefecture, Dali Prefecture, Wenshan Prefecture, Chuxiong Prefecture, Kunming City, Lincang City, Pu'er City, Baoshan City, Yuxi City, Zhaotong City and Qujing City) and were infected via intravenous drug abuse or sexual contact were collected. Cases with incomplete information, two or more duplicate records, lack of detection results and missing route of infection data were excluded. Additionally, patients' gender and age at the onset of HIV infection-related high-risk intravenous drug abuse or sexual contact (heterosexual or homosexual) were recorded, and statistical analysis was conducted on 5-year age groups. There were no patients younger than 9 years or older than 85 years in this study.

Ethics approval

The content and plan of this study were reviewed and approved by the Ethics Committee of Yunnan Academy of Traditional Chinese Medicine.

The experimental protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Ethics Committee of Yunnan Academy of Traditional Chinese Medicine. Written informed consent was obtained from individual or guardian participants.

Statistical analysis

SPSS 22.0 was used for data analysis. Qualitative data were described as either the number of cases or percentage, while quantitative data were expressed as the mean \pm standard deviation. The differences in age among patients with different routes of infection were analysed by the analysis of variance. Analysis of differences in nationality, marital status and educational background among patients with different routes of infection was performed by the chi-square test or the Fisher exact probability test. Among patients of both genders with the same route of infection, the differences in age were analysed using the chi-square test or the Fisher exact probability test.

3. Results

Demographic Characteristics of Patients with HIV Infection-related Intravenous Drug Abuse or Sexual Contact

Gender

Among the 7,632 patients with HIV/AIDS, males accounted for 61.98% and females for 38.02% (Table 1).

Table 1. Demographic characteristics of HIV/AIDS patients at the onset of HIV infection-related intravenous drug abuse or sexual contact in Yunnan province between 2005 and 2014.

| Variable | Male(n=4730) | | | X ² /F | p | Female(n=2902) | | | X ² /F | p |
|------------------------|------------------------|----------------------|--------------------|-------------------|---------------------|------------------------|----------------------|--------------------|-------------------|---------------------|
| | Intravenous drug abuse | Heterosexual contact | Homosexual contact | | | Intravenous drug abuse | Heterosexual contact | Homosexual contact | | |
| Age ^a | 35.77±5.85 | 39.33±11.92 | 33.40±10.83 | 86.810 | <0.001 | 34.67±5.78 | 35.30±10.50 | 37.20±17.63 | 0.691 | 0.501 |
| Ethnicity | | | | | | | | | | |
| Han | 1733(75.1) | 1700(71.7) | 40(78.4) | 7.285 | 0.026 | 286(83.6) | 1643(64.3) | 4(100.0) | 52.765 | <0.001 |
| Minority | 576(24.9) | 670(28.3) | 11(21.6) | | | 56(16.4) | 913(35.7) | 0(0.0) | | |
| Marital status | | | | | | | | | | |
| Married | 1052(45.6) | 1602(67.6) | 13(25.5) | 329.505 | <0.001 | 165(48.2) | 1915(74.9) | 3(75.0) | | <0.001 ^b |
| Unmarried | 945(40.9) | 510(21.5) | 33(64.7) | | | 124(36.3) | 248(9.7) | 1(25.0) | | |
| Divorced | 291(12.6) | 180(7.6) | 5(9.8) | | | 44(12.9) | 214(8.4) | 0(0.0) | | |
| Widowed | 21(0.9) | 78(3.3) | 0(0.0) | | | 9(2.6) | 179(7.0) | 0(0.0) | | |
| Educational background | | | | | | | | | | |
| College or higher | 27(1.2) | 239(10.1) | 20(39.2) | | <0.001 ^b | 7(2.0) | 140(5.5) | 0(0.0) | | <0.001 ^b |
| High school | 299(12.9) | 349(14.7) | 16(31.4) | | | 67(19.6) | 280(11.0) | 2(50.0) | | |
| Middle school | 1287(55.7) | 1020(43.0) | 7(13.7) | | | 216(63.2) | 1090(42.6) | 0(0.0) | | |
| Primary school | 432(18.7) | 509(21.5) | 5(9.8) | | | 32(9.4) | 564(22.1) | 1(25.0) | | |
| Pre-school | 5(0.2) | 4(0.2) | 0(0.0) | | | 4(1.2) | 10(0.4) | 0(0.0) | | |
| Illiteracy | 259(11.2) | 249(10.5) | 3(5.9) | | | 16(4.7) | 472(18.5) | 1(25.0) | | |

^a is the age at the onset of infection-related high-risk behaviors in the patient.

^b Fisher exact probability.

Age

There were statistically significant differences in age among males with HIV infection-related high-risk intravenous drug abuse, heterosexual contact, and homosexual contact ($P<0.001$). Among them, the mean age at the onset of HIV infection-related high-risk homosexual behaviour was the youngest (33.40 years), followed by the mean age at the onset of intravenous drug abuse (35.77 years), and lastly the mean age at the onset of heterosexual behaviour (39.33 years) (Table 1).

No significant difference in age was found among females with HIV infection-related high-risk intravenous drug abuse, heterosexual contact, or homosexual contact ($P>0.05$) (Table 1).

Ethnicity

Among the three types of HIV infection-related high-risk behaviour, the number of Han patients was obviously larger than the number of minority patients among both males and females ($P<0.05$, $P<0.001$, respectively) (Table 1).

Marital status

The differences in marital status among males with

HIV infection-related intravenous drug abuse, heterosexual contact and homosexual contact were statistically significant ($P<0.001$). Among them, the proportion of married males with HIV infection-related high-risk intravenous drug abuse and heterosexual contact accounted for 45.6% and 67.6%, respectively, while the proportion of unmarried males with HIV infection-related high-risk homosexual contact was the highest, accounting for 64.7% (Table 1).

Additionally, a statistically significant difference was found in marital status among females with HIV infection-related high-risk intravenous drug abuse, heterosexual contact and homosexual contact ($P<0.001$). Among all three types of high-risk behaviour, the proportion of married females was the highest, accounting for 48.2%, 74.9% and 75.0%, respectively (Table 1).

Educational background

Males with HIV infection-related intravenous drug abuse, heterosexual contact and homosexual contact presented significant differences in educational background ($P<0.001$). Among them, the proportion of males with middle school education with HIV infection-related high-risk intravenous drug abuse and heterosexual contact

accounted for 55.7% and 43.0%, respectively; the proportion of males with technical school education, junior college education or higher with HIV infection-related high-risk homosexual contact was the highest, accounting for 39.2% (Table 1).

Similarly, there were statistically significant differences in educational background among females with HIV infection-related high-risk intravenous drug abuse, heterosexual contact, and homosexual contact ($P < 0.001$). Among them, the proportion of females with middle school education with HIV infection-related high-risk intravenous drug abuse and heterosexual contact accounted for 63.2% and 42.6%, respectively; in addition, the proportion of females with high school education with HIV infection-related high-risk homosexual contact was the highest, accounting for 50.0% (Table 1).

Route of infection

Among the 7,632 HIV/AIDS patients, 2,651 (34.74%) patients were infected via intravenous drug abuse, 4,926 (64.54%) by heterosexual contact and 55 (0.72%) by homosexual contact (Table 2).

Age and gender distribution characteristics of patients at the onset of HIV infection-related high-risk intravenous drug abuse

Among the 2,651 HIV/AIDS patients infected via intravenous drug abuse, the number of males (2,309; 87.10%) with HIV infection-related high-risk intravenous drug abuse was 6.8 times more than the number of females (342; 12.90%). The age of males and females at the onset of high-risk HIV infection-related intravenous drug abuse ranged from 10 to 14 years. The number of males presented a gradually increasing trend from 15-19 years of age that peaked at 30-39 years of age, followed by a gradual decline in the older age groups; no reports on high-risk HIV infection-related intravenous drug abuse were found after 59 years of age. In females, the number of cases showed a gradually increasing trend from 20-24 years of age that peaked at 30-39 years of age, followed by a gradual decline in the older age groups; no reports on high-risk HIV infection-related intravenous drug abuse were found after 59 years of age (Table 2, Figure 1).

The distribution of males and females in each age group: in the 10-19 years age group, the proportion of

Table 2. Age and gender distribution characteristics of HIV/AIDS patients at the onset of high-risk intravenous drug abuse and sexual contact.

| Age groups | Intravenous drug abuse (n=2651) | | | | Heterosexual contact(n=4926) | | | | Homosexual contact(n=55) | | | |
|------------|---------------------------------|-------------|----------------|--------------------|------------------------------|-------------|----------------|--------|--------------------------|-------------|----------------|--------------------|
| | Male(n,%) | Female(n,%) | X ² | P | Male(n,%) | Female(n,%) | X ² | P | Male(n,%) | Female(n,%) | X ² | P |
| 10-14 | 9(0.4) | 1(0.3) | 0.000 | 0.999 | 0(0.0) | 12(0.5) | 11.154 | 0.001 | 0(0.0) | 0(0.0) | - | - |
| 15-19 | 5(0.2) | 0(0.0) | | 0.999 ^a | 8(0.3) | 21(0.8) | 4.923 | 0.026 | 4(7.8) | 0(0.0) | | 0.999 ^a |
| 20-24 | 47(2.0) | 11(3.2) | 1.941 | 0.164 | 110(4.6) | 289(11.3) | 73.396 | <0.001 | 17(33.3) | 0(0.0) | | 0.299 ^a |
| 25-29 | 259(11.2) | 60(17.5) | 11.265 | 0.001 | 317(13.4) | 535(20.9) | 49.078 | <0.001 | 13(25.5) | 2(50.0) | | 0.298 ^a |
| 30-34 | 687(29.8) | 104(30.4) | 0.061 | 0.804 | 498(21.0) | 564(22.1) | 0.806 | 0.369 | 9(17.6) | 0(0.0) | | 0.999 ^a |
| 35-39 | 730(31.6) | 98(28.7) | 1.216 | 0.270 | 477(20.1) | 416(16.3) | 12.289 | <0.001 | 4(7.8) | 1(25.0) | | 0.325 ^a |
| 40-44 | 397(17.2) | 51(14.9) | 1.104 | 0.293 | 344(14.5) | 262(10.3) | 20.728 | <0.001 | 2(3.9) | 1(25.0) | | 0.206 ^a |
| 45-49 | 143(6.2) | 15(4.4) | 1.736 | 0.188 | 210(8.9) | 192(7.5) | 2.986 | 0.084 | 0(0.0) | 0(0.0) | - | - |
| 50-54 | 23(1.0) | 1(0.3) | 0.953 | 0.329 | 114(4.8) | 102(4.0) | 1.970 | 0.160 | 1(2.0) | 0(0.0) | | 0.999 ^a |
| 55-59 | 9(0.4) | 1(0.3) | 0.000 | 0.999 | 95(4.0) | 82(3.2) | 2.274 | 0.132 | 1(2.0) | 0(0.0) | | 0.999 ^a |
| 60-64 | 0(0.0) | 0(0.0) | - | - | 80(3.4) | 45(1.8) | 12.968 | <0.001 | 0(0.0) | 0(0.0) | - | - |
| 65-69 | 0(0.0) | 0(0.0) | - | - | 60(2.5) | 19(0.7) | 24.922 | <0.001 | 0(0.0) | 0(0.0) | - | - |
| 70-74 | 0(0.0) | 0(0.0) | - | - | 29(1.2) | 14(0.5) | 6.492 | 0.011 | 0(0.0) | 0(0.0) | - | - |
| 75-79 | 0(0.0) | 0(0.0) | - | - | 25(1.1) | 2(0.1) | 21.516 | <0.001 | 0(0.0) | 0(0.0) | - | - |
| 80-85 | 0(0.0) | 0(0.0) | - | - | 3(0.1) | 1(0.0) | 1.159 | 0.282 | 0(0.0) | 0(0.0) | - | - |
| Total | 2309(100.0) | 342(100.0) | | | 2370(100.0) | 2556(100.0) | | | 51(100.0) | 4(100.0) | | |

^a Fisher exact probability.

males was slightly higher than that of females ($P>0.05$); among the 20-34 years age groups, the proportion of males in each 5-year age group was lower than that of females, especially the proportion of males in the 25-29 years age group ($P=0.001$); in the 35-59 years age groups, the proportion of males in each 5-year age group was slightly higher than that of females ($P>0.05$) (Table 2).

Age and gender distribution characteristics of patients at the onset of HIV infection-related high-risk heterosexual contact

Among the 4,926 HIV/AIDS patients infected via heterosexual contact, there was no obvious difference between the number of males (2,370; 48.11%) and females (2,556; 51.89%) with HIV infection-related high-risk heterosexual contact. The youngest age of males at the onset of high-risk HIV infection-related heterosexual contact was 15-19 years; the number of males was the largest in the 30-39 years age group, followed by a gradual decline in the later age groups; no high-risk heterosexual contact was reported after 85 years of age. The youngest age of females at the onset of high-risk HIV infection-related heterosexual contact was 10-14 years; the number of females was the largest in the 25-34 years age group, followed by a gradual decline in the later age groups; no high-risk heterosexual contact was reported after 85 years of age (Table 2, Figure 2).

The distribution of males and females in each age group: in the 10-34 years age groups, the proportion of males in each age group was lower than that of females, especially, in the 10-14, 15-19, 20-24, and 25-29 years age groups ($P=0.001$ or $P=0.026$ or $P<0.001$); in the 35-85 years age groups, the proportion of males in each age group was higher than that of females, especially, in the 35-39, 40-44, 60-64, 65-69, 70-74 and 75-79 years age groups ($P<0.001$ or $P=0.011$) (Table 2).

Age and gender distribution characteristics of patients at the onset of HIV infection-related high-risk homosexual contact

Among the 55 HIV/AIDS patients infected via homosexual contact, the number of males (51; 92.73%) with HIV infection-related high-risk homosexual contact was 12.8 times more than the number of females (4; 7.27%). The youngest age of males at the onset of high-risk HIV infection-related homosexual contact was 15-19 years; the number of males was the largest in the 20-24 years age group, and high-risk HIV infection-related homosexual contact was not reported after 59 years of age. Additionally, the youngest age of females at the onset of high-

risk HIV infection-related homosexual contact was 25-29 years (Table 2, Figure 3).

The distribution of males and females in each age group: due to the small number of female patients, those with homosexual contact were distributed between the 25-29 years age group ($n=2$), 35-39 years age group ($n=1$) and 40-44 years age group ($n=1$). In addition, there was no significant difference in the proportion of males and females in each age group ($P>0.05$) (Table 2).

Analysis of pulmonary tuberculosis in HIV patients with different high-risk behaviors

Among the 7,632 HIV/AIDS patients, 128 cases were complicated with pulmonary tuberculosis, and the percentage of intravenous drug abuse was the highest (76.56%), followed by heterosexual contact (21.88%) and homosexual contact was the least (1.56%) (Table 3).

Demographic characteristics of HIV/AIDS patients in Yunnan Province at the onset of HIV infection-related high-risk intravenous drug abuse and sexual behaviour

Heterosexual contact was responsible for infection in the largest proportion of patients (64.54%), followed by intravenous drug abuse (34.74%), and homosexual contact (0.72%). Among the 7,632 HIV/AIDS patients, males were more prevalent than females, with a ratio of 1.6:1. The mean age at the onset of HIV infection-related high-risk homosexual contact in males was the lowest (33.40 years), while that of heterosexual contact was the highest (39.33 years), as compared to the other two types of high-risk behaviour. No statistical significance was detected in the mean age of females at the onset of the three types of HIV infection-related high-risk behaviour ($P>0.05$). Among the three types of high-risk behaviour, Han patients were significantly more prevalent than minority patients among both males and females ($P<0.05$ or $P<0.001$). The proportions of married males with HIV infection-related high-risk intravenous drug abuse and heterosexual contact were the highest (45.6% and 67.6%, respectively), and the proportion of unmarried males with homosexual contact was the highest (64.7%). The proportions of married females with three types of HIV infection-related high-risk behaviour were similar. As compared to the other two types of HIV infection-related high-risk behaviour, there was a higher proportion of both males and females with homosexual contact who had a high educational background, perhaps due to having more disposable income to spend on sex^[10-11].

In this study, the males with high-risk homosexual

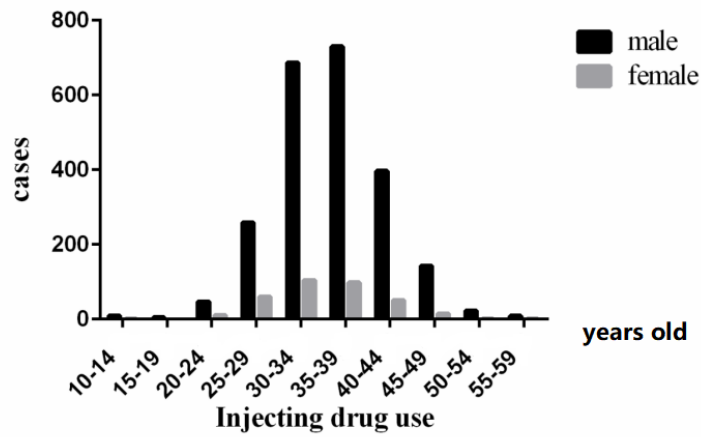


Figure 1. Graphical representation of the number of different age brackets of patients with HIV infection-related intravenous drug abuse. Male was colored in black, and female was colored in grey. The data of n, P and χ^2 were shown in Table 2.

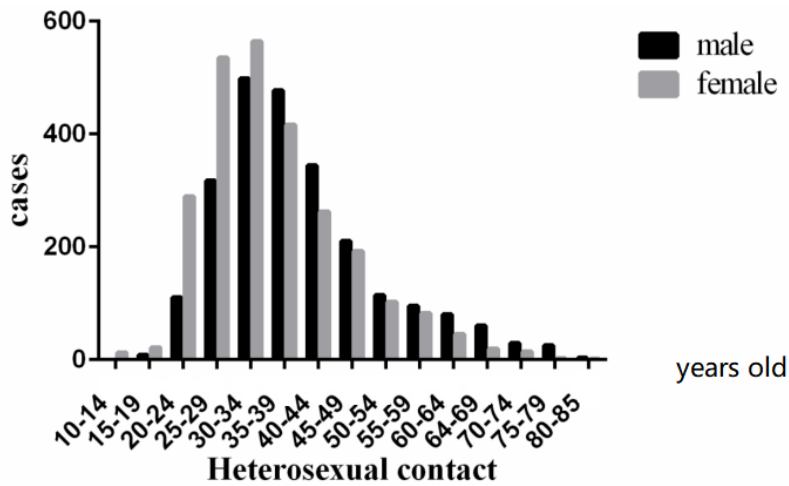


Figure 2. Graphical representation of the number of different age brackets of patients with HIV infection-related HIV infection-related high-risk heterosexual contact. Male was colored in black, and female was colored in grey. The data of n, P and χ^2 were shown in Table 2

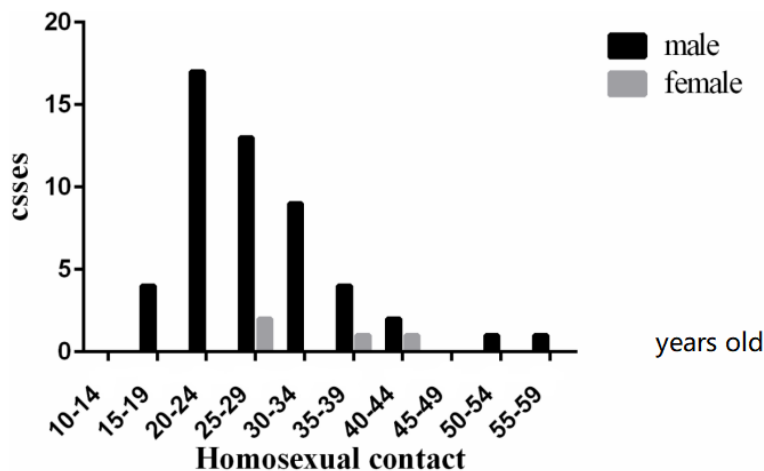


Figure 3. Graphical representation of the number of different age brackets of patients with HIV infection-related HIV infection-related high-risk homosexual contact. Male was colored in black, and female was colored in grey. The data of n, P and χ^2 were shown in Table 2.

contact were young and unmarried, with advanced educational degrees, as compared to those with other high-risk behaviour, perhaps because an open attitude towards sex, an active sex life and multiple sexual partners are common among younger MSM. The high frequency of changing sexual partners, unsafe sexual behaviour, and frequent mobility are also contributing causes^[12-15].

Age distribution characteristics of HIV/AIDS patients in Yunnan Province at the onset of HIV infection-related high-risk intravenous drug abuse

Since the HIV antibody was first detected in injecting drug users (IDUs) of Yunnan Province in 1989^[16], intravenous drug abuse has been the main cause of the spread of AIDS in that region. Although the annual incidence of HIV/AIDS in China has been stable in recent years, the patterns of transmission have evolved over time^[17,18]. In Yunnan, although HIV infection in IDUs has fallen^[19], it is still one of the leading causes of HIV infection. Among the 2,651 HIV/AIDS patients infected via intravenous drug abuse in this study, the age of both males and females at the onset of HIV infection-related high-risk intravenous drug abuse was 10-14 years. Our finding is not unique since a high level of risky injecting behaviour has been observed among younger IDUs in India, Canada and the United States^[20-23]. The age group with the most males and females was 30-39 years; however, these people often spread HIV to the general population through sexual contact^[24,25]. HIV infection-related high-risk intravenous drug abuse was not reported in males and females after 59 years of age, which could be due to the increasing HIV/AIDS mortality among IDUs with increasing age^[26].

Males with HIV infection-related high-risk intravenous drug abuse were 6.8 times more prevalent than females, which may be associated with greater social pressure and more temptation in males^[27]. After using drugs, females face greater social pressure, disapproval and rejection than males^[28]. In addition, females prefer less addictive drugs; thus, intravenous drug abuse occurs more commonly in males. In the 10-19 years age groups, the percentage of males was higher than that of females, suggesting an apparent tendency of intravenous drug abuse in younger males^[29], which may be related to more curiosity for new things in male adolescents^[30]. The percentage of males with intravenous drug abuse in each 5-year age group between 35-59 years was higher than the percentage of females with intravenous drug abuse, perhaps due to greater social and life pressures, tension, anxiety, depression and other negative emotions^[31]. Between 20-34 years of age, the percentage of males with intravenous drug abuse in

each age group was lower than the percentage of females with intravenous drug abuse, perhaps due to less educational opportunities, lower cultural health quality and a lack of survival skills in the females in this age group^[32].

Age distribution characteristics of HIV/AIDS patients in Yunnan Province at the onset of HIV infection-related high-risk heterosexual contact

Unsafe sexual behaviour, such as early sexual intercourse, unprotected sex and multiple sexual partners, are closely correlated with unintended pregnancy, sexually transmitted diseases, HIV infection and other diseases that harm reproductive health^[33,34]. Our study demonstrated that among the 4,926 HIV/AIDS patients infected via heterosexual contact. Meanwhile, a previous study showed that from 1985 to 2014, HIV-1 transmission in China is increasing faster among those with homosexual contact^[7], which seems different from the results of our investigation. This may be due to the unique Yunnan culture, where education and concepts of people lag behind, comparatively. That is, homosexual contact may not be accepted by the majority of people. So heterosexual contact and intravenous drug abuse play more important roles in HIV transmission. In our study, the youngest age of males at the onset of high-risk HIV infection-related heterosexual contact was 15-19 years, and the number of males infected via heterosexual contact was the highest at 30-39 years of age. Among females, the youngest age at the onset of high-risk HIV infection-related heterosexual contact was 10-14 years, and the number of females infected via heterosexual contact was the highest at 25-34 years of age, which may be related to the physiological characteristics of female puberty, lack of reproductive health and AIDS education, and the inclination for unprotected sex^[35-37]. Younger adolescents were more likely to report that they wished they had waited to have sexual intercourse, but for many, sexual behaviour at an early age can take a serious toll on both psychological and physiological well-being^[33]. After 85 years of age, no HIV infection-related high-risk heterosexual contact was reported in both males and females, which may be associated with a gradually increasing hypoactive sexual desire^[38].

There was no obvious difference between males and females with HIV infection-related high-risk heterosexual contact. Between 10-34 years of age, the percentage of males with heterosexual contact in each 5-year age group was lower than the percentage of females with heterosexual contact, which may be associated with earlier sexual development in females, lower sexual protection awareness and lack of effective AIDS prevention measures in young females^[39,40]. In addition, the percentage of males

in each age group between 35-85 years was higher than the percentage of females.

Age distribution characteristics of HIV/AIDS patients in Yunnan Province at the onset of HIV infection-related high-risk homosexual contact

Among the 55 HIV/AIDS patients infected via homosexual contact, there were 12.8 times more males than females, which may be associated with the inclination of unprotected sex, a higher anal insertion rate and a higher rate of being penetrated in homosexual males [14,41,42]. In addition, the youngest age of males at the onset of HIV infection-related high-risk homosexual contact was 15-19 years, and the number of males was the highest in the 20-24 years age group, resulting, potentially, from frequent sexual behaviour, multiple sexual partners, easy drunken sexual intercourse and vulnerability to sexual abuse in young male homosexuals [43-46]. Moreover, HIV infection-related high-risk homosexual contact was not reported in males after 59 years of age. The age of females at the onset of HIV infection-related high-risk homosexual contact was 25-29 years.

The incidence of pulmonary tuberculosis of 7632 HIV-related high-risk intravenous drug abuse and sexual contact patients in Yunnan Province

AIDS and pulmonary tuberculosis are common clinical infectious diseases, and the co-infection of the two poses great challenges to the prevention and control of infectious diseases [47]. Due to the immunodeficiency of AIDS patients and the influence of inflammatory factors, the probability of infection with exogenous *Mycobacterium tuberculosis* is significantly higher than that of non-AIDS patients. It was found in this study that among 128 AIDS patients with pulmonary tuberculosis infection, intravenous drug abuse accounted for the highest proportion (76.56%) of the three high-risk behaviors related to HIV infection, which may be related to the increased risk of tuberculosis of drug users due to the closed and group use of drugs [48].

3. Discussion

From September 2005 to October 2017, among the 7,632 HIV/AIDS patients surveyed in Yunnan Province, the proportion infected via heterosexual contact was the largest, while the proportion infected via homosexual contact was the smallest. Additionally, the proportion of males was larger than that of females. As compared to patients with other high-risk behaviours, the males with HIV infection-related high-risk homosexual contact were

younger, unmarried, and more likely to have an advanced educational degree. Han patients were more prevalent than minority patients in both males and females with the three types of high-risk behaviours. HIV infection-related intravenous drug abuse at a lower age was more common among males than females. No obvious difference existed between the number of males and females with HIV infection-related heterosexual contact, which occurred earlier in females than males. The number of males with HIV infection-related high-risk homosexual contact was more than the females. Furthermore, the latest age at the onset of the three types of HIV infection-related high-risk behaviour, in both males and females, was found in the heterosexual contact group. There were no reports of HIV infection-related high-risk heterosexual contact after 85 years of age. Despite wide antiretroviral scale-up during the past two decades resulting in declining new infections and mortality globally, HIV-associated tuberculosis remains as a major public health concern. Tuberculosis is the leading HIV-associated opportunistic infection and the main cause of death globally and, particularly, in resource-limited settings. In our research, Among AIDS patients with pulmonary tuberculosis infection, intravenous drug abuse accounted for the highest proportion (76.56%) of the three high-risk behaviors related to HIV infection. The route of HIV infection is related to bad behavior and outcome, because intravenous drug use is not only related to HIV infection, and drug addiction can reduce the patient's compliance with anti-tuberculosis treatment and affect the effect of anti-tuberculosis treatment. For AIDS patients, getting rid of drug addiction or reducing high-risk behaviors such as the use of unclean needles, and BCG vaccination can help reduce the risk of combined TB double infection.

Limitations

First, we included only the demographic, age and gender distribution characteristics of HIV/AIDS patients with high-risk intravenous drug abuse and sexual contact from the database of Chinese Medicine Treatment of AIDS Pilot Project of Yunnan Province (patients treated in 44 treatment points in nine prefectures and cities in Yunnan Province from September 2005 to October 2017), which reflects the distribution of patients but not morbidity. Second, a few AIDS patients infected via homosexual contact may have claimed to be infected by heterosexual contact due to social rejection, discrimination and shame related to homosexuality.

It is known that the subtypes of HIV are transmitted via different infectious routes. Along the drug route, subtypes B and C can be transmitted. Subtype CRF01_AE

was introduced into Yunnan through sexual activities with people from bordering countries. Moreover, circulating recombinant form (CRF) 01_AE has been found in infected men who have sex with men. Yunnan can be a 'transfer station' of HIV multidirectional transmission between China and its neighbouring countries. Therefore, it is important to study the subtypes of HIV in Yunnan Province.

Given our technique and sample restrictions, this part has not been investigated in the current study.

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Conflicts of Interest/Competing Interests

Not applicable.

Ethics Approval

The content and plan of this study were reviewed and approved by the Ethics Committee of Yunnan Academy of Traditional Chinese Medicine.

The experimental protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Ethics Committee of Yunnan Academy of Traditional Chinese Medicine. Written informed consent was obtained from individual or guardian participants.

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

Consent for Publication

Patients signed informed consent regarding publishing their data and photographs.

Availability of Data and Material

The data sets supporting the results of this article are

included within the article and its additional files.

Code Availability

Not applicable.

Authors' Contributions

Qin Li performed the data analyses and wrote the manuscript, and was a major contributor in writing the manuscript;

Weibo Wen contributed to the conception of the study.

Li Wang performed the experiment;

Fang Ye participated in fund us photography;

Juexuan Wang helped perform the analysis with constructive discussions.

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