Comparison of Demographic Features of Identified PLWHAs Transmitted through Commercial and Non-marital Non-Commercial Heterosexual Contact in China from 2015–2018: A Retrospective Cross-Sectional Study

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Abstract

Background：

To understand the characteristics of people living with HIV/AIDS(PLWHAs) infected through commercial heterosexual contact (CHC) and non-marital non-commercial heterosexual contact (NMNCHC) is important for the AIDS prevention work in China.

Methods:

All cases reported through the Chinese HIV/AIDS Case Reporting System (CRS) from 2015 to 2018 were included in this study. A descriptive analysis of the socio-demographic characteristics of interest was made. Chi-square or Fisher's exact tests, Cochran–Armitage test, and Student t-test were applied in data analysis.

Results：

Totally 523, 121 identified PLWHAs were included in this study. From 2015 to 2018. In heterosexual transmission, the composition of commercial heterosexual contact (CHC) decreased from 40.18% to 37.99%, while that of non-marital non-commercial heterosexual contact (NMNCHC) increased from 46.33% to 49.02%. In the non-marital non-commercial heterosexual contact (NMNCHC) group, the rates of male versus female were 1.50:1, 1.51:1, 1.54:1, 1.52:1, while in the commercial heterosexual contact (CHC) group, this rate were 11.45:1, 12.08:1,12.53:1, 13.28:1. Those who infected through non-marital non-commercial heterosexual contact(NMNCHC) were significantly younger compared with the people infected through commercial heterosexual contact (CHC) (P<0.01), with an average age gap ranged from 5.63 to 7.46. This age difference was greater in males (age gap: 5.46~7.82) than in females (age gap: 0.27~1.62).

Conclusions：

Non-marital non-commercial heterosexual contact (NMNCHC) plays an increasingly crucial role in heterosexual transmission. Cases infected through commercial heterosexual contact (CHC) and non-marital non-commercial heterosexual contact (NMNCHC) varied significantly in gender, age and other social demographic characteristics.

1. Background

The epidemic of AIDS in China has been sustained for more than 30 years, and it has undergone significant changes in the mode of transmission, infected population, epidemic areas and many other aspects. In recent years, sexual transmission became the predominant route of HIV transmission in China [1]. In 2007, the number of HIV/AIDS transmitted heterosexually exceeded that of blood infections for the first time[2], and by 2013, sexually transmitted HIV/AIDS cases already accounted for 90.8 percent of newly discovered HIV/AIDS cases[3], among which heterosexual transmission occupied 69.4%. [1]. During the following years, newly reported cases infected through heterosexual contact remained around two-thirds of total transmission[4–7]. According to the report of *National AIDS and STD Epidemic* in the third quarter of 2018, 29416 cases of newly discovered HIV /AIDS cases in China were transmitted through heterosexual contact, accounting for 71.1% of the total[8].

The heterosexual transmission can be divided into three broad types: those acquired within marriage or another live-in partnership, those acquired when selling or buying sex and those acquired in sex with a casual partner, including transient girlfriends and boyfriends[9]. Since different transmission routes have varied characteristics and risk factors, the prevention and control strategies of HIV/AIDS through heterosexual transmission should be formulated and carried out according to different heterosexual transmission modes [10,11]. In order to distinguish different types of heterosexual contact, in 2014, the option of contact history including commercial heterosexual contact and non-commercial heterosexual contact were added as the sub-classification of non-marital heterosexual transmission in Chinese HIV/AIDS Case Reporting System (Chinese HIV/AIDS CRS), so as to distinguish those transmitted through commercial heterosexual contact (CHC) or non-marital non-commercial heterosexual

contact(NMNCHC).

Commercial heterosexual contact（CHC） played a significant role in HIV transmission[12,13], and female sex workers (FSWs) and male clients of FSWs were among the key populations monitored by the National Sentinel Surveillance System[14]. In 2015, 193 931 FSWs were tested. The overall HIV positive rate was 0.19%, while the rates were 0.39%, 0.10% and 0.07% among FSWs from low, medium and high-level venues respectively[15]. Despite a seemingly low HIV prevalence among FSWs in China, the scale and risk of HIV infection is enormous given the size of the population of FSWs and their clients[16].   Many studies have shown that the male clients of FSWs are important bridges for HIV transmission from FSWs to the low-risk general population[17–21].

Furthermore, several regional studies with comparatively small sample size had noticed that non-marital non-commercial heterosexual contact (NMNCHC) accounted for an increasingly high proportion in the non-marital heterosexual transmission in some areas [22–27]. However, piecemeal data could not provide a broad picture of nationwide characteristics and trends. PLWHAs transmitted through non-marital non-commercial heterosexual contact (NMNCHC) tend to have open-minded attitudes towards sexuality, and the frequency of casual sexual behavior is relatively high. In the meantime, the concealment and diversity of this kind of sexual behavior significantly increased the difficulty of controlling the spread of AIDS[25]. To understand the characteristics of cases infected through commercial heterosexual contact (CHC) and non-marital non-commercial heterosexual contact (NMNCHC) is important for the AIDS prevention work in China, however, there is a lack of national level analysis to explore the epidemic characteristics of these two transmission routes and how they are different from each other. Therefore, this study applied data from the Chinese HIV/AIDS CRS to analyze the main epidemic characteristics of commercial heterosexual contact (CHC) and non-marital non-

commercial heterosexual contact (NMNCHC) in China from 2015 to 2018.

2. Methods

2.1 Data Sources

China established the HIV/AIDS case reporting system (CRS) in 1985, Every new infection identified at local hospitals or clinics run by the Chinese Centers for Disease Control and Prevention (CDC) is reported through this web-based system, and completed case reports were communicated to the National Center for AIDS/STD Control and Prevention (NCAIDS) for data quality monitoring and logic checks. Local CDC personnel and NCAIDS staff will double evaluate and identify mistakes in logic and duplication at the local and national level. These measures ensure that the system could obtain information on PLWHA throughout the country[28].

The data was from the CRS and had been authorized by the National Center for AIDS/STD Control and Prevention, China CDC. All identified HIV/AIDS cases captured from 2015 to 2018 in the Chinese HIV/AIDS Case Reporting System (CRS) were included in our study. Personal information was removed from the database prior to analysis so as to protect participants' privacy.

2.2 Definitions

a. Non-marital heterosexual contact (NMHC): the sexual contact experience with non-marital heterosexual partners, including commercial and non-commercial heterosexual contact. Those acquired HIV within marriage or from another live-in partnership were excluded.

b. Commercial heterosexual contact (CHC): the experience of commercial sexual contact with a non-marital heterosexual partner, including those acquiring HIV when selling or buying sex.

c. Non-marital non-commercial heterosexual contact (NMNCHC): experience of non-

commercial sexual contact with a non-marital heterosexual partner, including those acquired

HIV from transient girlfriends and boyfriends, as well as any other casual heterosexual

partners.

d. "HIV" referred to the presence of HIV infection at the time of reporting, "AIDS" referred to

diagnosed AIDS patients, "HIV/AIDS" implied either HIV infection or an AIDS case[28].

2.3 Statistical analysis

1) Descriptive analysis：Sociodemographic characteristics such as gender, age, routes of

infection, marital status and educational level were taken into consideration, frequencies of all

variables were calculated over the successive study years.

2) Comparison analysis: The distribution characteristics of CHC and NMNCHC in different age,

gender groups, marital status and educational status were compared. Data on gender, marital

and educational status were expressed as proportions (%). The distribution differences were

analyzed by Chi-square or Fisher's exact tests, and trends were tested by Cochran–Armitage

test, and the means of age in different groups were compared by the Student t-test. $p < 0.05$

was considered statistically significant.

2.4 Statistical software

Data analysis was performed in SPSS 21.0 software (IBM Inc., Armonk, NY, USA), R (The R

Foundation for Statistical Computing, R 3.6.1), using the RStudio interface (RStudio, Inc. Version

1.2.5033) and Microsoft Excel 2019 (Microsoft Corp 2019).

3. Results

Totally 523, 121 identified HIV/AIDS cases captured from 2015 to 2018 in the CRS were

analyzed, among which 359, 812 cases were reported to be infected through heterosexual contact (HC).

3.1 The constituent ratio

The proportion of people infected through HC increased yearly from 66.25% to 71.48% from 2015 to 2018 (Figure 1*A*). There are four subtypes of HC, including Non-marital Non-commercial Heterosexual Contact (NMNCHC), Commercial Heterosexual Contact (CHC), Marital Contact (MC), Unclassified (UC) Both NMNCHC and CHC are the subtypes of non-marital heterosexual contact. During the study period (2015~2018), the proportion of CHC decreased from 40.18% to 37.99%, whereas the proportion of NMNCHC increased from 46.33% to 49.02% (Figure 1*B*).

Among the males who reported transmission through non-marital heterosexual contact, the proportion of CHC group declined year by year, from 57.05% to 54.46%, while the proportion of NMNCHC increased from 42.95% to 45.54%. In the female non-marital heterosexual group, the proportion of female CHC decreased from 14.85% to 12.02%, while the NMNCHC proportion was much higher and raised annually from 85.15% to 87.98% during the study years (Figure 1*C*).

In the CHC group, the male proportion was quite high and also increased yearly from 91.97% to 93.00%. Correspondingly, the female rate decreased from 8.03% to 7%. The ratios of male to female were 11.45:1, 12.08:1,12.53:1, 13.28:1. While in the NMNCHC group, the gender proportion was relatively stable, with males accounting for 60.06% ~

60.27%, and the ratios of male and female were 1.50:1, 1.51:1, 1.54:1, 1.52:1

respectively from 2015 to 2018.   (Figure 1*C*).

3.2 Age differences

There was a significant difference in age between PLWHA infected through CHC and

NMNCHC from 2015 to 2018(P<0.01). Those who infected through NMNCHC were

significantly younger than the cases transmitted through CHC, with an average age gap

ranging from 5.63 to 7.46 years. The average age of the two groups increased annually,

the average age of CHC group increased from 48.32 to 52.69, and the mean age of

NMNCHC group increased from 42.69 to 45.23(Table 1).

3.3 Frequency distribution of NMNCHC and CHC by age

From 2015 to 2018, the size of the NMNCHC group increased in all age groups, but that

of CHC group decreased significantly in 20~24 and 25~29 age groups. Moreover, the

frequency of NMNCHC group was higher than that of CHC group in all age groups under

55 years old, especially in the age group from 20~40. However, there was an obvious

variation in the age group over 60, in which the number in the NMNCHC group was

significantly lower than that of CHC group, and it peaked in the age group over 65, in

which the frequency of NMNCHC group was 1.52~1.59 times that of CHC group. In the

65+ age group, the CHC group showed a significant rise, and the proportion of cases

over 65 years in CHC group increased from 17.92% to 25.71%, while that in NMNCHC

group increased from 10.24% to 13.06% from 2015 to 2018. (Figure 2).

3.4 Age differences by gender

The age of male PLWHAs in CHC group was significantly higher than that in NMNCHC group(P<0.01), and the mean age difference was 5.46 years (2015) to 7.82 years (2018). In the female group, there was no significant difference in age between the two groups in 2015. From 2016 to 2018, the age of the CHC group was significantly higher than that of the NMNCHC group, but the age difference was much smaller than that of the male group, which ranged from 0.27 (2015) to 1.62 (2018) (table 2).

3.5 Frequency distribution of NMNCHC and CHC by age and gender

The ratios of male to female in CHC group were 11.45:1, 12.08:1,12.53:1, 13.28:1 from 2015 to 2018(figure 1C). A comparison by age group revealed that the age groups of 60~64 and 65~ had much higher sex ratios, which were 15.34:1, 14.94:1, 18.06:1, 16.64:1 in the age group of 60~64, and 37.80:1, 38.33:1, 40.12:1, 34.16:1 in the age group of 65~. Under the age of 40, most age groups of CHC showed a downward trend, but after age 40, there was an increase which peaked at 65~ for both genders. Females remained a low proportion in all age groups, hence the increase of CHC was mainly determined by the males in the older age groups (figure 3).

On the other hand, in the NMNCHC group, the ratios of male to female were 1.50:1, 1.51:1, 1.54:1, 1.52:1 respectively during the study years(figure 1C), but in the age group of 65~, the sex ratios were 2.87:1, 2.71:1, 2.61:1, 2.28:1. The average annual growth rate of both female and male in NMNCHC was higher than CHC in all age

groups, except for males in the 65 + age group, in which CHC group was 23.39%, exceeding 20.71% in the NMNCHC group. The sex ratio remained relatively stable in all age groups in NMNCHC, however, there was a significant increase in the younger age groups, especially the age group of 25~29, which rose from 1.49:1 to 1.91:1 during the study years, and became the second highest among all age groups in the year of 2018. (figure 3).

3.6 Marital and Educational status of CHC and NMNCHC cases from 2015 to 2018.

During the study years, the married proportion of the CHC group was relatively stable, ranging from 51.20% to 51.48%, while the married proportion of NMNCHC increased from 49.1% in 2015 to 51.02% in 2018, the composition of divorced or widowed increased annually in both groups, while the unmarried rate decreased in both groups. Chi Square tests of marital status between two groups revealed that the distribution of marital status were significantly different between the groups in all the study years, $\chi2$ (2015)=94.668, $p < 0.0001$, 2016, $\chi2$ (2016) =109.88, $p < 0.0001$, $\chi2$ (2017) =58.18, $p < 0.0001$, $\chi2$ (2018) =152.38, $p < 0.0001$.

The educational level in the CHC group changed during the study years; the proportion of junior high school and above decreased annually, while the proportion of primary school and illiteracy increased annually. The NMNCHC group followed a similar trend, except the proportion of educated in college or above was comparatively stable, only reduced by 0.68% (from 10.10 to 9.52%), compared with a 2.05% (from 7.39% to 5.34%) decline in the CHC group. The distribution trends of two groups were tested by

Cochran–Armitage test, and Z(2015)=10.222, p < 0.0001, Z(2016) =17.882, p < 0.0001, Z (2017) =20.777, p < 0.0001, Z (2018) =16.341, p < 0.0001, which indicated that the proportion of NMNCHC increased with the improvement of education level.

4. Discussion：

To our knowledge, this is the first study to compare the basic socio-demographic characteristics of PLWHAs who were reported to be infected through CHC and NMNCHC at the national level. By analyzing data from Chinese HIV/AIDS CRS from 2015 to 2018, we have gained a basic understanding of the epidemic characteristics of non-marital heterosexual HIV transmission (commercial and non-commercial) and explored the differences between CHC and NMNCHC.

HIV/AIDS transmitted through HC has become the main mode of transmission in China, and NMNCHC plays an increasingly important role in heterosexual transmission.

While HIV/AIDS transmitted through homosexual and heterosexual contact were both increasing, this analysis provided further indications that heterosexual contact had become the main mode of HIV transmission in China. In the meantime, the proportion of NMNCHC increased annually, indicating that NMNCHC plays an increasingly important role in HIV transmission and gradually becomes the main transmission mode of heterosexual contact. These findings support the conclusions of some small sampled regional studies at the national level[25–27].

HIV/AIDS cases infected through CHC and NMNCHC have different age and gender characteristics.

In non-marital transmissions, males were more likely to report HIV transmitted through CHC, about 10% more than NMNCHC, while the opposite was true for females, near 90% of females were reported to be infected through NMNCHC. Furthermore, the number of males in the CHC group was 11.45-13.28 times more than females. The ratio of males to females in the NMNCHC group was about 1.5 times.

In general, the average age of CHC group was much higher than NMNCHC group, which was mainly due to the much higher number of CHC over the age of 60, as well as the much lower frequency in cases under 60. In the meantime, the age difference between the two groups were mainly due to males. Some studies also noticed the increasing HIV infection among older people[29–31] , and they were playing a more important role in local transmission[32]. The increasing number of both females and males in NMNCHC group was higher than CHC group in all age groups, except for males in the over 65 age group, where CHC group was higher than NMNCHC group. The sex ratio of the 25-29 age group NMNCHC group increased significantly, while that of the 65~ age group remained at a high level, the reasons behind this phenomenon deserve further study. This may be because men aged 25 to 29 are sexually active, more likely to have casual sex and concurrent relationships, and with the development of social networking apps, casual sex is more likely to happen. As erectile dysfunction medications (EDMs) have

become popular among older males to enhance sexual desire and performance, their infection increased greatly and kept at a high level[33]. Therefore, In the CHC group, we shall establish a more effective strategy for the control and prevention of the infection among clients of FSW, especially the older people, while in the NMNCHC group, specific prevention and control strategies should be developed for both men and women, and for age groups with gender-skewed growth, such as those aged 25 to 29, further research and specific strategies should be made. The marital status was significantly different between the groups in all the study years, probably because unmarried people are more likely to be younger and engaged in a casual heterosexual relationship, while divorced or widowed people are more likely to be older and to be engaged in commercial heterosexual behavior. As the improvement of educational level, the proportion of NMNCHC would also increase, age might also play an important role in the education difference between two groups. Further studies are needed to rule out the effects of confounders and explore these factors' influence on the likelihood to be infected through CHC or NMNCHC.

Limitations:

There are several limitations of this study. The sexual contact history in the CRS is self-reported. It is difficult to apply objective measures for verification, therefore, it is possible that the identified HIV/AIDS lied about their contact history due to social desirability. Some HIV/AIDS patients may conceal their exposure to other high-risk sexual behaviors, such as male's exposure to homosexual sex or female's exposure to

commercial sex[24]. Further, "newly reported cases" should not replace incidence, because they may represent exposures that were prevalent many years earlier[14]. Since this is an ecological study, and the analysis is mainly conducted at the univariate or bivariate level, so there may be ecological fallacy and confounding in the relationship, the factors related to CHC and NMNCHC need to be further explored. Moreover, there may be some unreported cases that might influence our conclusions. However, the large sample size nationwide might make up for these deficiencies to some extent.

5. Conclusions:

To sum up, this is the first nationwide targeted analysis of the epidemic status of cases infected through commercial and non-commercial contact in non-marital heterosexual transmission. NMNCHC has become the main mode of transmission in China, playing an increasingly significant role in heterosexual transmission. PLWHAs infected through CHC and NMNCHC have different characteristics such as age and sex, education level etc. In terms of commercial heterosexual transmission, more effective strategies should be adopted to prevent HIV/AIDS infection of elderly clients of FSW. While in the non-marital non-commercial heterosexual transmission, we should target both males and females simultaneously, and pay more attention to age groups with gender-skewed growth, such as those aged 25 to 29.

List of abbreviations

AIDS: Acquired Immune Deficiency Syndrome; HIV: Human Immunodeficiency Virus; CRS:

Chinese HIV/AIDS Case Reporting System; NMNCHC: Non-marital Non-commercial

Heterosexual Contact; CHC: Commercial Heterosexual Contact. FSW: Female Sex Workers;

PLWHA: People Living with HIV/AIDS

DECLARATIONS

Authors' contributions

ZLD, CC, L.Y.M, FL, GFG. participated in study design; ZLD, CC, FL performed data

analysis; ZLD, LYM and FL drafted the manuscript; ZLD, CC, LYM, FL, and GFG were

responsible for study conception; all authors provided critical review of the manuscript

and approved the final draft for publication.

Availability of data and materials

The datasets used and analyzed during the current study are available from the

corresponding author on reasonable request.

Ethics approval and consent to participate

This study was reviewed and approved by the ethics committees of the National Center

for AIDS/STD Control and Prevention, Chinese Center for Disease Control and

Prevention(X190311560).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Wu Z. [Characteristics of HIV sexually transmission and challenges for controlling the epidemic in China]. Chinese J Epidemiol. 2018;39(6):707–9.

2. Wang L, Wang N, Wang L, Li D, Jia M, Gao X, et al. The 2007 Estimates for People at Risk for and Living With HIV in China: Progress and Challenges. J Acquir Immune Defic Syndr. 2009;50(4):414–8.

3. Hao Y, Cui Y, Sun X, Guo W, Xia G, Ding Z, et al. [A retrospective study of HIV/AIDS situation: a ten-year implementation of "four frees and one care" policy in China]. Chin J Dis Control Prev. 2014;18(5):369–74.

4. NCAIDS, NCSTD, China CDC. [Update on the AIDS/STD epidemic in China the third quarter of 2017]. Chin J AIDS STD. 2017;23(11):981.

5. NCADS, NCSTD, China CDC. [Update on the AIDS/STD epidemic in China and main response in control and prevention in December, 2013]. China J AIDS STD. 2014;20(2):75.

6. NCAIDS, NCSTD, China CDC. [Update on the AIDS/STD epidemic in China in December, 2016]. Chi J AIDS STD. 2017;23(2):93.

7. NCAIDS, NCSTD, China CDC. [Update on the AIDS/STD epidemic in China and main response in control and prevention in December, 2014]. Chin J AIDS STD. 2015;21(2):87.

8. NCAIDS, NCSTD, China CDC. [Update on the AIDS/STD epidemic in China the third quarter of 2018]. Chin J AIDS STD. 2018;24(11):1075.

9. Wu Z. HIV/AIDS in China: beyond the numbers [M]. Singapore:Springer, 2017.

10. Li Y, Lin Z, Xie Y, Lin P. [Epidemiologic characteristics and strategies on prevention and control of sexually transmitted human immunodeficiency virus/acquired immunodeficiency syndrome in China]. Chin J Prev Medicine. 2018;52(12):1309–14.

11. Lyu F. [Discussion of HIV control and prevention strategies]. Chin J Prev Medicine. 2016;50(10):841–5.

12. Prüss-Ustün A, Wolf J, Driscoll T, Degenhardt L, Neira M, Calleja J. HIV due to female sex work: regional and global estimates. Plos One. 2013;8(5):e63476.

13. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and

meta-analysis. Lancet Infect Dis. 2012;12(7):538–49.

14. Wu Z, Wang Y, Detels R, Bulterys M, McGoogan JM. HIV/AIDS in China. 2020;

15. Ge L, Li D, Li P, Guo W, Cui Y. [Population specific sentinel surveillance for HIV infection syphilis and HCV infection in China during 2010 - 2015]. DISEASE SURVEILLANCE. 2017;32(2):111–7.

16. Poon AN, Han L, Li Z, Zhou C, Li Y, Huang L, et al. Acceptability and willingness of HIV pre-exposure prophylaxis amongst female sex workers in China. Aids Care. 2019;1–10.

17. Zhu J, Lian D, Yin Y, Hu D, Wang N, Chen L, et al. [HIV prevalence and correlated factors on male clients of female sex workers in Hekou Yao autonomous county of Yunnan province, 2014-2015]. Chin J Epidemiol. 2019;40(4):440–5.

18. Zhu J, Hu D, Yin Y, Zhu Z, Wang N, Wang B. HIV prevalence and correlated factors among male clients of female sex workers in a border region of China. Plos One. 2019;14(11):e0225072.

19. Jin X, Smith K, Chen RY, Ding G, Yao Y, Wang H, et al. HIV prevalence and risk behaviors among male clients of female sex workers in Yunnan, China. J Acquir Immune Defic Syndr. 2010;53(1):131–5.

20. Huang Z, Wang W, Martin M, Nehl E, Smith B, Wong F. "Bridge population": sex workers or their clients? -- STI prevalence and risk behaviors of clients of female sex workers in China. Aids Care. 2011;23 (suppl 1):45–53.

21. Pan S, Parish WL, Huang Y. Clients of female sex workers: a population-based survey of China. J Infect Dis. 2011;204 (suppl 5): S1211-7.

22. Wang L, Ding Z, Qin Q, Cai C, Guo F, Cui Y. [Characteristics of HIV transmission through heterosexual contact in China, 2008-2014]. Chin J Epidemiol. 2015;36(12):1332–6.

23. Chen F, Guo W, Wang L, Li D, Qin Q, Li P, et al. [Characteristics of HIV/AIDS cases with extra-marital heterosexual transmission in some regions in China]. Chin J AIDS STD. 2015;21(7):550–3.

24. Song W, Wang S, Wang L, Xu J, Chen T. [Study on the features and real reasons of HIV infection among HIV infected people who are reported as infected through non-married heterosexual contact in Yili]. Chin J AIDS STD. 2016;22(10):822–7.

25. Yu Q, Xu P, Lin P, Li Y, Wang L, Li D, et al. [Epidemiological characteristics and latent class analysis of non-marital heterosexual behaviors among human immunodeficiency virus/acquired immunodeficiency syndrome individuals in Jiangmen, Guangdong province

between 2015 and 2017]. Chin J Prev Medicine. 2018;52(12):1269–75.

26. Yu Q, Wang F, Xu P, Wen H, Xiong Y, Yang J, et al. [Characteristics of non-marital and non-commercial heterosexual transmission of HIV infection in Miao-Dong Autonomous prefecture of Qiandongnan]. Chin J Prev Medicine. 2017;51(11):977–81.

27. Chen J, Wu H, Zhang X, Luo Y, Ding J. [Characteristics of newly reported HIV/AIDS cases with non-marital but non-commercial heterosexual transmission in Hangzhou, 2015-2017]. Chin J Epidemiol. 2018;39(12):1602–6.

28. Xing J, Li Y, Tang W, Guo W, Ding Z, Ding G, et al. HIV/AIDS Epidemic Among Older Adults in China During 2005–2012: Results From Trend and Spatial Analysis. Clin Infect Dis. 2014;59(2):e53–60.

29. Zhang W, Zhang Y, Shen X, Li L, Tang H, Peng G, et al. [Epidemiologic characteristics of aged HIV/AIDS cases older than 50 years reported through internet based direct reporting system in Hubei province]. Jiangsu J Prev Med. 2018;29(5):497-499+567.
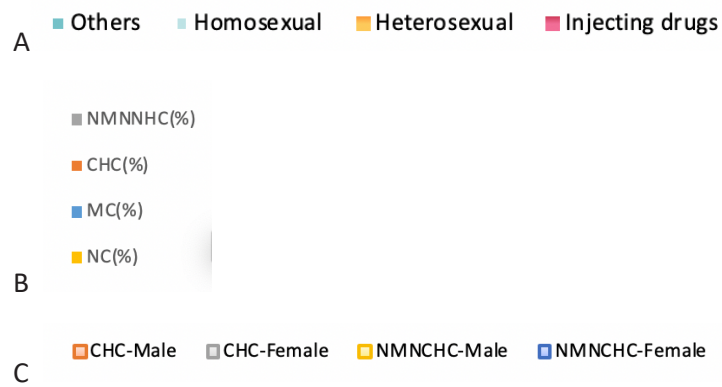
30. Wu X, Feng X, Kelly C, Shen Z, Chen H, Lu H, et al. HIV Infections Among Older Male Clients of Low-Cost Commercial Sex Venues in Southern China. Int J Sex Health. 2017;29(1):48–54.

31. Wang L, Qin Q, Ge L, Ding Z, Cai C, Guo W, et al. [Characteristics of HIV infections among over 50-year-olds population in China]. Chin J Epidemiol. 2016;37(2):222–6.

32. Wu J, Zhang Y, Shen Y, Wang X, Xing H, Yang X, et al. Phylogenetic analysis highlights the role of older people in the transmission of HIV-1 in Fuyang, Anhui Province, China. BMC Infect Dis. 2019;19(1):562.

33. Tang Z, Wu X, Li G, Shen Z, Zhang H, Lan G, et al. Aphrodisiac Use Associated with HIV Infection in Elderly Male Clients of Low-Cost Commercial Sex Venues in Guangxi, China: A Matched Case-Control Study. Plos One. 2014;9(10):e109452.

Figure 1. *A*, Constituent ratio of diverse HIV infection routes from 2015~2018. *B*, Constituent ratio of various heterosexual transmission routes in 2015-2018. *C*, Constituent ratio of gender among NMNCHC and CHC from 2015 to 2018. *NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact; MC: Marital Contact; UC: Unclassified.*

A

■ Others ■ Homosexual ■ Heterosexual ■ Injecting drugs

B

■ NMNNHC(%)
■ CHC(%)
■ MC(%)
■ NC(%)

C

□ CHC-Male □ CHC-Female □ NMNCHC-Male □ NMNCHC-Female

Figure 2. Comparison of the frequency distribution of NMNCHC and CHC in different age groups

from 2015 to 2018. *Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact;*

CHC: Commercial Heterosexual Contact.

Group
- CHC
- NMNCHC

Year
- 2015
- ▲ 2016
- ■ 2017
- + 2018

Figure 3. Comparison of the frequency distribution of CHC and NMNCHC by age and gender from

2015 to 2018. *Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC:*

Commercial Heterosexual Contact.