

# Factors Associated with Commercial or Non-Commercial Contact in Non-Marital Heterosexual Transmission from Chinese HIV/AIDS Case Reporting System in 2018: A Cross-Sectional Study

**Zhilong Dong**

Chinese Center for Disease Control and Prevention <https://orcid.org/0000-0003-4927-1488>

**Liying Ma**

China CDC

**Chang Cai**

China CDC

**Lokachet Tanasugan**

UCLA

**George Fu Gao**

China CDC

**Fan Lv** (✉ [fanlv@chinaaids.cn](mailto:fanlv@chinaaids.cn))

Chinese Center for Disease Control and Prevention <https://orcid.org/0000-0003-3294-4754>

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## Research article

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# Abstract

**Background:** In recent years, HIV transmission through heterosexual contact has been on the rise, accounting for more than 69% in 2017{Cui, 2020 #27}. Therefore, an in-depth understanding of the characteristics of heterosexual transmission will greatly improve our effectiveness in preventing AIDS.

**Methods:** All identified People Living With HIV/AIDS (PLWHAs) reported as transmitted through heterosexual transmission in the Chinese HIV/AIDS Case Reporting System (CRS) in 2018 were included in this study. A multivariate logistic regression model was applied to evaluate the relationship between socio-demographic characteristics and the overall risk of being transmitted through commercial heterosexual contact (CHC) or non-marital non-commercial heterosexual contact (NMNCHC).

**Results:** A total of 92026 cases of non-marital heterosexual transmission with no missing data were included in the analysis. There were 40244 (43.73%) cases infected through CHC and 51782 (56.27%) infected through NMNCHC. One year increase in age was associated with 0.98 times the odds of being reported as infected through NMNCHC (aOR = 0.98, 95% CI = 0.9783-0.9806,  $p < 0.0001$ ), significantly higher odds of infection through NMNCHC was observed with females (aOR = 8.39, 95% CI = 8.03-8.77,  $p < 0.0001$ ), non-farmers (OR = 1.22, 95% CI = 1.18-1.26,  $p < 0.0001$ ), minorities (aOR = 1.94, 95% CI = 1.86-2.02,  $p < 0.0001$ ), those with education level of college and above (aOR = 1.49, 95% CI = 1.38-1.61,  $p < 0.0001$ ), and migrants in the different city of the same province (aOR = 1.28, 95% CI = 1.21-1.34,  $p < 0.0001$ ).

**Conclusions:** Among heterosexual transmission, Younger people, ethnic minorities, migrants within province, as well as those with comparatively higher socioeconomic status were more likely to be transmitted through non-marital non-commercial heterosexual contact (NMNCHC). More interfere measures and targeted strategies should be made for the HIV transmission through this route.

## 1. Background

In China, past efforts have been mostly concentrating on the HIV control among high risk populations, such as drug users(1). However, in recent years, a number of factors, including population mobility, social and cultural diversity, contribute to the transmission from high-risk groups to the general population, especially through sexual transmission(2).

In 2007, heterosexual transmission surpassed blood transmission for the first time, and became the primary transmission route of HIV/AIDS in China(3). Since then, the proportion of heterosexual sexual transmission increased annually. From 2013 to 2017, the proportion of those transmitted through heterosexual contact accounted for 69.4%~69.6% of the total identified People Living With HIV/AIDS (PLWHAs) in the Chinese HIV/AIDS Case Reporting System (CRS) (Fig. 1) (4, 5), and reached 71.1% in the third quarter of 2018(6).

Among those transmitted through heterosexual contact, the proportion of non-marital transmission increased from 78.2% in 2008 to 88.2% in 2014 and remained at a high level(7). Moreover, several regional studies have noticed that the identified PLWHAs transmitted through non-marital non-commercial heterosexual contact (NMNCHC) accounted for a higher proportion than commercial heterosexual contact (CHC)(8–12). Transmission through NMNCHC is more extensive, more hidden and more difficult to monitor, making it a major obstacle in the way of HIV/AIDS prevention(12).

HIV/AIDS is not only a medical disease, but also a social problem(13), Therefore, an in-depth understanding of the characteristics of heterosexual transmission route will greatly improve our effectiveness in preventing HIV/AIDS. Up until now, no study has ever explored the characteristics of social demographic factors correlated with the identified PLWHAs reported as transmitted through CHC or NMNCHC at the national level. Therefore, in order to get a better understanding of the heterosexual transmission, this study applied the CRS data in 2018 to analyze the factors that might be correlated with the two major routes of transmission in heterosexual transmission, the CHC or NMNCHC.

## **2. Materials And Methods**

### **2.1 Data source**

The CRS was established in 1985 and began to report cases online in 2005, using a standardized case report form and face-to-face interviews to collect information of identified PLWHAs. The CRS has uniformly designed the reporting, review and analysis procedures for the reporting institutions at all levels. In addition, logical check and required items can be carried out on the system to ensure the accuracy and completeness of the information(14). The data from CRS have been authorized by the National Center for AIDS/STD Control and Prevention, China CDC. All identified HIV/AIDS cases during the year of 2018 (Jan.1st 2018 to Dec 31st 2018) in the CRS were included in our study. Personally identifiable/sensitive information, such as name, ID number, phone number, etc., was removed from the database prior to analysis so as to protect participants' privacy. 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).

### **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. NMHC comprises of commercial heterosexual contact (CHC) and non-marital non-commercial heterosexual contact (NMNCHC).

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.

## 2.3 Statistical analysis

Socio-demographic factors such as route of infection, gender, age, ethnic, education level, migration status, marital status were all taken into consideration. Categorical variables were expressed as frequencies and percentages and compared by Pearson Chi-square or Fisher's exact tests. The difference of continuous variable, such as age, was examined by the Student t-test. Variables significant in the univariate analysis entered into a multivariate model so as to evaluate the relationship between socio-demographic characteristics and the overall possibility of being transmitted through CHC or NMNCHC. The results were expressed as odds ratios (ORs) and 95% CIs. Statistical significance was based on two-sided p-value lower than 0.05.

## 2.4 Statistical software

R (The R Foundation for Statistical Computing, R 3.6.1), using the RStudio interface (RStudio, Inc. Version 1.2.5033).

## 3. Results

### Descriptive analysis and Comparison of CHC and NMNCHC

In 2018, 71.48% of identified PLWHAs were reported to be transmitted through heterosexual contact, among which 87.01% were transmitted through non-marital heterosexual contact, including CHC and NMNCHC. After deleting the observations containing missing values (385 cases, 0.42% of total cases) in the interested variables, a total of 92026 cases of non-marital heterosexual transmission were included in the analysis. There were 40244 (43.73%) cases infected through CHC and 51782 (56.27%) infected through NMNCHC. 25.38% of non-marital heterosexual transmission were females and 74.62% were males (Table 1). The average age of all cases was  $48.52 \pm 16.01$ , among which the mean age of CHC group was  $52.7 \pm 15.49$ , and that of NMNCHC group was  $45.27 \pm 15.65$ , and there was a significant difference of mean age between the two groups ( $t = 71.901$ ,  $P < 0.0001$ ), with an age gap of 7.43 years (Table 2). The frequency of cases aged 50 and above was obviously higher in the CHC group and lower in the younger group. Meanwhile, the mean age difference between CHC and NMNCHC was much smaller in female (CHC vs NMNCHC = 46.79 vs 45.16), and the main reason for the mean age difference between the two groups was due to males (CHC vs NMNCHC = 53.15 vs 45.34) (Fig. 1). Gender distribution was significantly different between the groups of CHC (male:93.02%; female:6.98%, male:female = 13.33:1) and NMNCHC (male: 60.32%, female:39.68%, male:female = 1.52:1). Moreover, there were significant differences in the distributions of NMNCHC and CHC in terms of occupation, ethnic, educational level, situation of migration, marital status (Table 1).

Table 1  
Bivariable analysis of factors associated with CHC and NMNCHC in 2018

| Variables  | n(%)              | CHC n(%)          | NMNCHC n(%)   | $\chi^2$ | P          |
|--|-------------------|-------------------|---------------|----------|------------|
| <b>Gender</b>  |                   |                   |               |          |            |
| Males  | 68673<br>(74.62%) | 37436(3.02%)      | 31237(60.32%) | 12784    | P < 0.0001 |
| Females  | 23353<br>(25.38%) | 2808(6.98%)       | 20545(39.68%) |          |            |
| <b>Occupation</b>  |                   |                   |               |          |            |
| Farmer   | 54682<br>(59.52%) | 25694<br>(63.85%) | 28988(55.98%) | 580.56   | P < 0.0001 |
| Others   | 37344<br>(40.58%) | 14550(36.15%)     | 22794(44.02%) |          |            |
| <b>Ethnic</b>  |                   |                   |               |          |            |
| HAN  | 72023<br>(78.26%) | 34781(86.43%)     | 37242(71.92%) | 2799.6   | P < 0.0001 |
| Minority   | 20003<br>(21.74%) | 5463(13.57%)      | 14540(28.08%) |          |            |
| <b>Education level</b>   |                   |                   |               |          |            |
| Illiteracy   | 11536<br>(12.54%) | 4168(10.36%)      | 7368(14.23%)  | 1401.6   | P < 0.0001 |
| Primary school   | 34138<br>(37.10%) | 17014(42.28%)     | 17124(33.07%) |          |            |
| Junior high school   | 29257<br>(31.79%) | 13033(32.38%)     | 16224(31.33%) |          |            |
| High school or technical secondary school  | 10080<br>(10.95%) | 3886(9.66%)       | 6194(11.96%)  |          |            |
| College and above  | 7015<br>(7.62%)   | 2143(5.33%)       | 4872(9.41%)   |          |            |
| <b>Situation of Migration</b>  |                   |                   |               |          |            |
| Same county  | 56849<br>(61.77%) | 25795(64.10%)     | 31054(59.97%) | 247.84   | P < 0.0001 |
| Different county in the same city  | 19324<br>(21.00%) | 8326(20.69%)      | 10998(21.24%) |          |            |
| * Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact. |                   |                   |               |          |            |

| Variables  | n(%)              | CHC n(%)      | NMNCHC n(%)   | $\chi^2$ | P          |
|--|-------------------|---------------|---------------|----------|------------|
|  | 9129<br>(9.92%)   | 3410(8.47%)   | 5719(11.04%)  |          |            |
| Different city in the same province  | 9129<br>(9.92%)   | 3410(8.47%)   | 5719(11.04%)  |          |            |
| Different province   | 6724<br>(7.31%)   | 2713(6.74%)   | 4011(7.75%)   |          |            |
| <b>Marital Status</b>  |                   |               |               | 106.5    | P < 0.0001 |
| Married  | 47333<br>(51.43%) | 20771(51.61%) | 26562(51.30%) |          |            |
| Divorced or widowed  | 26371<br>(28.66%) | 12020(29.87%) | 14351(27.71%) |          |            |
| Unmarried  | 18322<br>(19.91%) | 7453(18.52%)  | 10869(20.99%) |          |            |
| * Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact. |                   |               |               |          |            |

Table 2  
Age comparison for PLWHAs transmitted through CHC and NMNCHC in 2018

| group  | n     | mean  | SD    | age gap | t      | p        |
|--|-------|-------|-------|---------|--------|----------|
| CHC  | 40244 | 52.70 | 15.49 | 7.43    | 71.901 | < 0.0001 |
| NMNCHC   | 51782 | 45.27 | 15.65 |         |        |          |
| * Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact. |       |       |       |         |        |          |

## Multivariate logistic regression

NMNCHC was taken as the dependent variable, while gender, age, occupation, ethnic, education level, situation of migration and marital status were the independent variables. Odds ratios (OR) from univariate logistic analyses and adjusted odds ratios (aOR) from multivariable models are presented in Table 3. Multivariate logistic regression analysis indicated that, among newly reported PLWHAs in 2018, One-year increase in age was associated with 0.98 times the odds of being reported as infected through NMNCHC (aOR = 0.98, 95% CI = 0.9783–0.9806, p < 0.0001). Meanwhile, the odds of being reported as infected through NMNCHC among female was 8.77 times the odds among male. (aOR = 8.39, 95% CI = 8.03–8.77, p < 0.0001); non-farmers was 1.22 times that of other occupations (OR = 1.22, 95% CI = 1.18–1.26, p < 0.0001); and minorities was 1.94 times higher compared with Han (aOR = 1.94, 95% CI = 1.86–

2.02,  $p < 0.0001$ ). Compared to the married cases, those divorced or widowed (aOR = 1.04, 95% CI = 1.00-1.07,  $p < 0.0001$ ) had 1.04 times the odds of being reported as infected through NMNCHC. Compared to illiteracy, those with education level of college and above (aOR = 1.49, 95% CI = 1.38–1.61,  $p < 0.0001$ ) had 1.49 times the odds to be reported as infected through NMNCHC. Compared to the resident in the same county, those lived in the different city of the same province (aOR = 1.28, 95% CI = 1.21–1.34,  $p < 0.0001$ ) had 1.28 times the odds of being reported as infected through NMNCHC (Table 3).

Table 3

Univariate and multivariate logistic regression analysis of factors associated with transmission through CHC and NMNCHC

| Variables                                    | univariate logistic regression |                 | multivariate logistic regression |                 |
|--|--------------------------------|-----------------|----------------------------------|-----------------|
|  | OR (95%CI)                     | P               | aOR (95%CI)                      | P               |
| <b>Gender</b>                                |                                |                 |                                  |                 |
| Males  |                                |                 |                                  |                 |
| Females                                      | 8.77(8.41–9.15)                | < 2e-16<br>***  | 8.39(8.03–8.77)                  | < 2e-16<br>***  |
| <b>Age</b>                                   |                                |                 |                                  |                 |
|  | 0.9703 (0.9695–0.9711)         | < 2e-16<br>***  | 0.98(0.9783–0.9806)              | < 2e-16<br>***  |
| <b>Occupation</b>                            |                                |                 |                                  |                 |
| Farmer                                       |                                |                 |                                  |                 |
| Others                                       | 1.39(1.35–1.43)                | < 2e-16<br>***  | 1.22(1.18–1.26)                  | < 2e-16<br>***  |
| <b>Ethnic</b>                                |                                |                 |                                  |                 |
| HAN  |                                |                 |                                  |                 |
| Minority                                     | 2.49(2.40–2.57)                | < 2e-16<br>***  | 1.94(1.86–2.02)                  | < 2e-16<br>***  |
| <b>Education level</b>                       |                                |                 |                                  |                 |
| Illiteracy                                   |                                |                 |                                  |                 |
| Primary school                               | 0.57(0.55–0.59)                | < 2e-16<br>***  | 0.76(0.72–0.80)                  | < 2e-16<br>***  |
| Junior high school                           | 0.70(0.67–0.74)                | < 2e-16<br>***  | 0.83(0.79–0.88)                  | 6.86e-11<br>*** |
| High school or technical<br>Secondary school | 0.90(0.85–0.95)                | 0.00024<br>***  | 1.07(1.00-1.14)                  | 0.0629 .        |
| College and above                            | 1.29(1.21–1.37)                | 7.65e-15<br>*** | 1.49(1.38–1.61)                  | < 2e-16<br>***  |
| <b>Situation of Migration</b>                |                                |                 |                                  |                 |
| Same county                                  |                                |                 |                                  |                 |
| Different county in the same city            | 1.10(1.06–1.13)                | 3.29e-08<br>*** | 1.08(1.04–1.12)                  | 3.22e-05<br>*** |

‘\*\*\*’ Significant at 0.001 ‘\*\*’ Significant at 0.01 Significant at ‘\*’ 0.05 \* Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact.

|  | univariate logistic regression |                 | multivariate logistic regression |                 |
|--|--------------------------------|-----------------|----------------------------------|-----------------|
| Different city in the same province  | 1.39(1.33–1.46)                | < 2e-16<br>***  | 1.28(1.21–1.34)                  | < 2e-16<br>***  |
| Different province   | 1.23(1.17–1.29)                | 4.99e-15<br>*** | 1.03(0.97–1.09)                  | 0.3163          |
| <b>Marital Status</b>  |                                |                 |                                  |                 |
| Married  |                                |                 |                                  |                 |
| Divorced or widowed  | 0.93(0.91–0.96)                | 8.77e-06<br>*** | 1.04(1.00-1.07)                  | 0.0417 *        |
| Unmarried  | 1.14(1.10–1.18)                | 1.02e-13<br>*** | 0.92(0.88–0.96)                  | 9.49e-05<br>*** |
| <i>‘***’ Significant at 0.001 ‘**’ Significant at 0.01 Significant at ‘*’ 0.05* Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact.</i> |                                |                 |                                  |                 |

## 4. Discussion

This study found that in the year of 2018, the percentage of identified PLWHAs reported to be transmitted through CMNCHC is 12.54% higher than through CHC in non-marital heterosexual transmission in China. The enhanced proportion of transmission through NMNCHC implicated to a certain extent that HIV is spreading gradually from the high-risk population to the general. Moreover, there were significant differences in the socio-demographic characteristics of cases transmitted through NMNCHC and CHC.

In the transmission of CHC, the proportion of males was 13.33 times higher than that of females, in contrast, the distribution ratio of males and females in NMNCHC was much more balanced, with males being only 1.52 times that of females. After controlling for other factors, the odds of females to be transmitted through NMNCHC was 8.39 times that of males. All of this suggests that males were more likely to be infected through CHC, while females had a much higher proportion to be infected through NMNCHC. Some studies suggested that clients of female sex workers (FSWs) were important bridges to spread HIV from high-risk groups to the general population through heterosexual behavior, making them a key target for intervention(15, 16). The chain of transmission is such that the clients of FSWs become infected with HIV through CHC, which is transmitted to the general females through NMNCHC, and the infected general females continued to transmit other males through NMNCHC, and HIV then began to spread among the general population.

This study found that younger people were more likely to be infected through NMNCHC, while older people were more likely to be infected through CHC. People over 50 years old are still sexually active, and they may seek sex with FSWs or casual partners, especially those who do not have spouses or stable sexual partners(17, 18). The aphrodisiac usage promoted this behavior and enhanced the risk(19). Furthermore, since HIV prevalence among low-tier FSWs was high and older people were more likely to be

engaged in sexual behavior with the low-tier FSWs, hence they were at high risk for HIV infection through this channel(20). All these factors could contribute to the enhanced possibility of older people being transmitted through CHC. By contrast, the higher possibility of young people infected through NMNCHC was probably due to that they were more likely to be engaged in casual sex and the growth of social networking platforms had made casual sex more accessible. A study of 735 male bachelors found that 16.5 percent of the sample had experienced casual sex with someone they met online, and they were more inclined to engage in high-risk sex when having sex with those partners, and more likely to be 28 ~ 35 years old(21).

The odds of being transmitted through NMNCHC among minorities were 94% higher than Han Chinese. It was common for some ethnic minorities in China to have multiple casual sexual partners due to their traditional beliefs on marriage and open attitude towards sex. For instance, casual sex had already become the predominant risk factor for HIV transmission now in Liangshan, where feature populations composed primarily of ethnic minorities(22). One study interviewed 108 Yi villagers aged 15 ~ 35 in Liangshan Yi ethnic minority region, they found that 82.4% of the young people had casual sex behaviors, 54.9% of which never used condoms(23).

Those who live in the different city of the same province had higher odds to be reported as infected through NMNCHC compared with the resident in the same county. Studies found that migrants were vulnerable to risky sexual behaviors(24). Rural-to-urban migrant males were significantly less likely to report condom use at first sex and consistent contraceptive use with first partner compared to non-migrants and urban-to-urban migrants(25). The reasons why migrants of different provinces were more likely to be transmitted through CHC while migrants of different city in the same province were more likely to be reported to be transmitted through NMNCHC still need further study. This may be due to the higher proportion of rural-to-urban migrants in different cities within the same province, or the greater availability of commercial services in provinces with more migrations from other provinces.

PLWHAs with higher levels of education and occupations other than farming were more likely to report infection through NMNCHC. It was probably due to their relatively higher socioeconomic status and stronger competence to obtain more non-marital non-commercial sexual partners. By contrast, people of relatively low socioeconomic status are more likely to patronize low-end FSWs, significantly increasing the likelihood of infection through CHC. Moreover, in multivariate analysis, there was little difference in marital status between the two types of heterosexual transmission routes. Further research is needed to explore the reasons behind these phenomena.

## Limitations

For reasons such as stigmatization or social desirability, some MSM might report to be transmitted through heterosexual transmission, either CHC or NMNCHC, while some females may be sex workers but reported to be transmitted through NMNCHC. Furthermore, it is possible for both genders to be reported as sexual transmission, while they were actually infected through drug abuse. Although the data

collectors on the front line would have some control and judgment to avoid misreport, the proportion of heterosexual transmission could still be overestimated to some extent. Because the data is self-reported, the possibility of these misstatements is difficult to eliminate, and further research is required to determine the extent to which false reports of transmission routes exist and how much they affect the overall transmission routes distribution.

Although China had made great achievements in the HIV prevention of high-risk groups, transmission through CHC still accounts for a high proportion, suggesting that there are still blind spots in the prevention and control of commercial sex transmission. On the other hand, for NMNCHC, a transmission route that is most widespread and hidden, as well as the most difficult to control, effective prevention strategy shall be developed according the features of this population, so as to realize early prevention.

## **5. Conclusions**

PLWHAs reported as transmitted through NMNCHC already exceeded CHC, which implicated that HIV spreading was increasing gradually among general population. Among heterosexual transmission, females, young people, ethnic minorities, migrants within province, as well as those with comparatively higher socioeconomic status were more likely to be transmitted through NMNCHC. Specialized and in-depth studies are required, and targeted strategies should be established for the HIV transmission through NMNCHC.

## **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**

## **Availability of data and materials**

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

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## **Authors' contributions**

ZLD, CC, FL, GFG. participated in study design; ZLD, CC, FL performed data analysis; ZLD, LYM and FL, LT drafted the manuscript; ZLD, CC, FL, and GFG were responsible for study conception; all authors provided critical review of the manuscript and approved the final draft for publication.

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## 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.

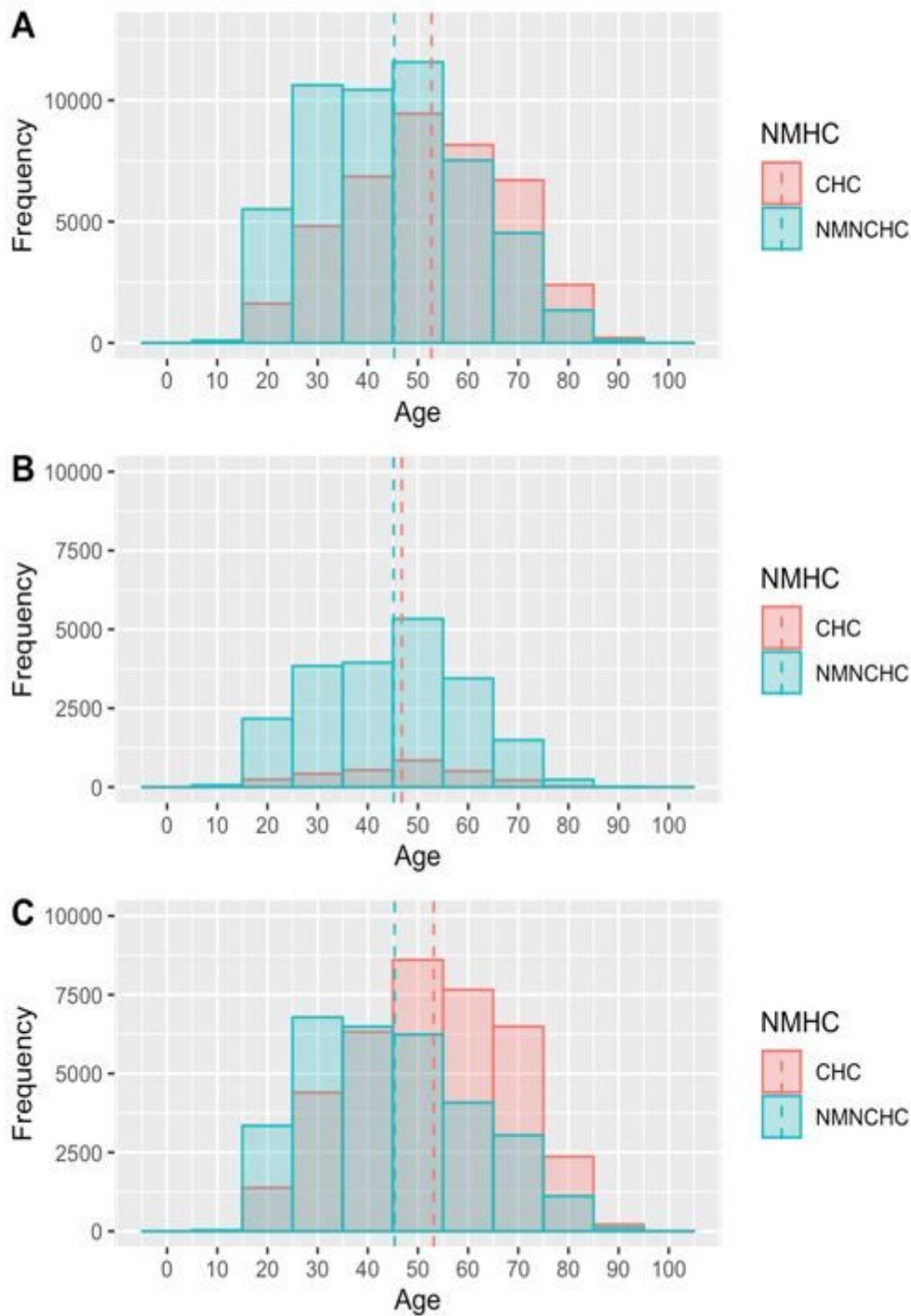
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## Figures



**Figure 1**

A. Age distribution of identified PLWHAs reported as transmitted through CHC and NMNCHC in 2018; B. Age distribution of CHC and NMNCHC in female; C. Age distribution of CHC and NMNCHC in male. \* Abbreviation: NMNCHC: Non-marital Non-commercial Heterosexual Contact; CHC: Commercial Heterosexual Contact.