Vital Surveillances

Comparative Analysis of Epidemiological Features of HIV/AIDS Cases Aged Over and Under 50 Years Old — China, 2010–2022

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ABSTRACT

Introduction: Recent data indicate a year-on-year increase in the proportion of human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) cases reported among individuals aged ≥50 in China. This study compares the epidemiological characteristics of HIV/AIDS cases in populations above and below 50 years of age. By doing so, it seeks to scrutinize the current epidemiological landscape of HIV within these distinct age cohorts and suggest tailored interventions for each group.

Methods: We utilized data from the Chinese HIV/AIDS Comprehensive Response Information Management System for our comparative analysis. Joinpoint regression analysis was employed to assess the trends in standardized detection rates.

Results: In China, the number of newly reported HIV/AIDS cases in the 15–49 age group increased from 51,436 in 2010 to 55,397 in 2022, while it increased from 11,751 in 2010 to 51,856 in 2022 in the group aged ≥50 years. Recent years have seen a greater proportion and detection rate of HIV/AIDS cases among the ≥50 age demographic compared to the 15–49 age group. In 2022, significant statistical differences were observed between males and females in both age cohorts with respect to education, marital status, occupation, mode of transmission, location of diagnosis, and region.

Conclusions: The observed trend of a rising proportion of HIV/AIDS cases in individuals aged 50 years and older necessitates heightened attention. It is imperative that we develop and implement interventions specifically designed to prevent and control the transmission of HIV within this demographic.

As the global population ages, there is a concurrent persistence of high-risk behaviors among individuals aged 50 and older, leading to an escalating incidence of human immunodeficiency virus (HIV) infections within this demographic (*1*). Data from China indicates a consistent rise in the proportion of people aged 50 and above living with HIV/acquired immune deficiency syndrome (AIDS) (PLWHA) (*2*). Research suggests that the reported infection rates for HIV/AIDS vary with age, with a notably higher incidence recorded among the elderly, defined as persons aged 50 years and older (*3*). Extensive literature indicates that HIV transmission has extended beyond high-risk populations to infect the general population, particularly the elderly. Yet, the majority of prior studies have primarily concentrated on high-risk behaviors in the 15–49 age cohort, with little comparative analysis on the epidemiological characteristics of HIV/AIDS cases among individuals aged 15–49 years and those aged 50 and above. This study seeks to address this gap by investigating the epidemiological trends and demographic attributes of HIV/AIDS cases in China, stratified by age groups over and under 50 years, reported between 2010 and 2022. The objective is to elucidate the current epidemiological landscape of HIV among these populations and to propose age-specific interventions tailored to each group.

METHODS

Data from the Chinese HIV/AIDS Comprehensive Response Information Management System (CRIMS) were utilized to assess the epidemiological profile of newly diagnosed HIV infections in individuals aged 15–49 years and ≥50 years. Medical facilities and the regional Centers for Disease Control (CDCs) use the CRIMS to report cases. The permission to access data in the CRIMS database was obtained from the National Center for AIDS/STD Control and Prevention, China CDC. All newly reported PLWHA in the CRIMS between 2010 and 2022 were included in our study. The detection rate was calculated as the number of newly identified cases within a given year

divided by the respective population size for that age bracket.

For the statistical analysis, Chi-square tests were employed to examine differences by using SPSS software (version 24.0, IBM Inc., Armonk, NY, USA). To assess trends in standardized incidence rates, we conducted Joinpoint regression analysis with the Joinpoint Regression Program (version 4.9.0.0, March 2021; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute), devised by Kim et al. (4). Additionally, the annual percent change (APC) was determined through Joinpoint regression analysis. The years were designated as the independent variable (x_i), and the number of HIV/AIDS cases was considered the dependent variable (y_i). Gender and age were classified as categorical variables. The grid search method (GSM) was applied to detect turning points and model parameters. Furthermore, the modified Bayesian information criterion (MBIC) was employed to ascertain the optimal model. The model with the smallest MBIC value was selected as the optimal one for analyzing the time trend of new detection rates and calculating the APC. A significance threshold (α) was set at 0.05, with a *P*-value of less than 0.05 indicating statistical significance.

RESULTS

In China, the number of newly reported HIV/AIDS cases in the 15–49 age group increased from 51,436 in 2010 to 55,397 in 2022, while it increased from 11,751 in 2010 to 51,856 in 2022 in the group aged ≥50 years. In the male group, the percentage of individuals aged 50 and older with HIV/AIDS saw a significant increase from 19.57% in 2010 to 44.39% in 2022 (χ^2=30,268.80, *P*<0.01). Similarly, among females, the percentage of HIV/AIDS in those aged 50 and above rose markedly from 16.26% in 2010 to 62.78% in 2022 (χ^2=12,529.83, *P*<0.01). Among new diagnoses in China, males aged between 15 and 49 accounted for 79.24% of cases, resulting in a gender ratio of 3.82∶1. Among the demographic aged 50 and older, 73.34% of cases were male, with a reduced gender ratio of 2.75∶1 (Figure 1).

The trend in detection rates of HIV/AIDS case from 2010 to 2022 was rising, with a little decline after 2019. For males, the detection rate of HIV/AIDS cases in the ≥50 age group exceeded that of the 15–49 age group around 2017. Conversely, in females, the detection rates remained relatively stable across both age groups, although the detection rate for those aged 50 and over was greater than that for the 15–49 cohort beginning around 2014 (Figure 2). A comparative analysis of the annual new detection rates for HIV/AIDS cases across different gender and age groups revealed an upward trend for males aged 50 and above, with rates climbing from 0.5 per 10,000 in 2010 to 2.2 per 10,000 in 2019, before the trend reversed and fell to 1.5 per 10,000 by 2022. Joinpoint regression analysis indicated an APC of 18.3% [95% confidence interval (*CI*): 16.1%, 20.6%] from 2010 to 2018 and an APC of –8.0% (95% *CI*: –11.2%, –4.6%) from 2018 to 2022. In females aged 50 and over, detection rates rose from 0.2 per 10,000 in 2010 to 0.8 per 10,000 in 2019, then similarly reversed,
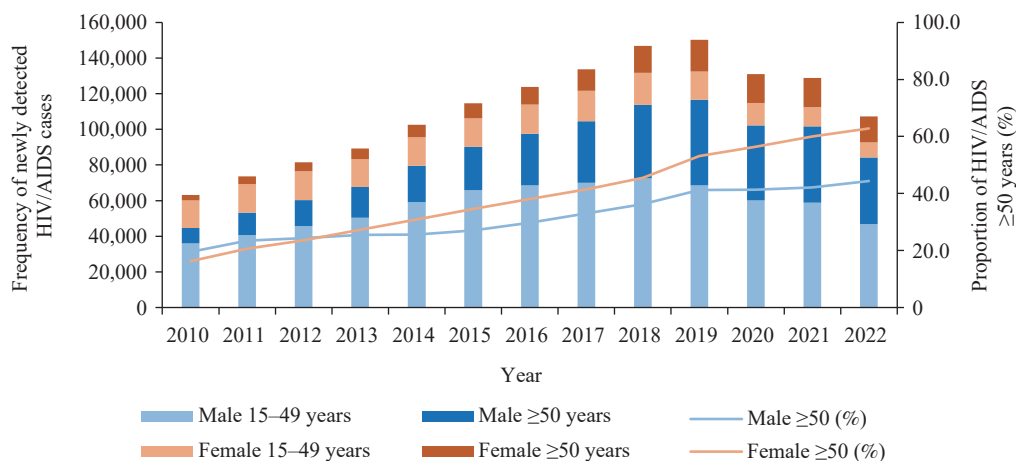

FIGURE 1. Frequency of HIV/AIDS cases in individuals aged 15–49 and ≥50 years, and proportion of HIV/AIDS cases in individuals aged ≥50 years between male and female in China, 2010–2022.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.

decreasing to 0.6 per 10,000 in 2022. Joinpoint regression analysis for this group showed an APC of 19.2% (95% *CI*: 17.2%, 21.4%) from 2010 to 2018 and an APC of –6.7% (95% *CI*: –9.6%, –3.7%) from 2018 to 2022 (Table 1).

In 2022, significant disparities were observed among different age cohorts, distinguished by gender. Our analysis revealed that men and women across these groups presented statistically significant dissimilarities in terms of educational background, marital status, occupation, transmission route, site of diagnosis, and region (*P*<0.01). Furthermore, when comparing age groups, distinct patterns in transmission routes emerged (χ^2=72,936.81, *P*<0.01).

In the 15–49 age category, heterosexual transmission was predominant, accounting for 55.62% (30,813/55,397) of cases. This trend was even more pronounced in those aged 50 and above, with heterosexual transmission representing 90.16% (46,754/51,856) of instances. Notably, among men aged 15–49, homosexual transmission constituted a significant proportion at 50.13% (23,463/46,802). In contrast, the rate for homosexual transmission was markedly lower in men aged 50 and above, at 11.04% (4,125/37,358).

In terms of female cases, however, non-mainstream non-commercial heterosexual contact (NMNCHC) (12,595/22,448, 56.11%) was identified as the primary
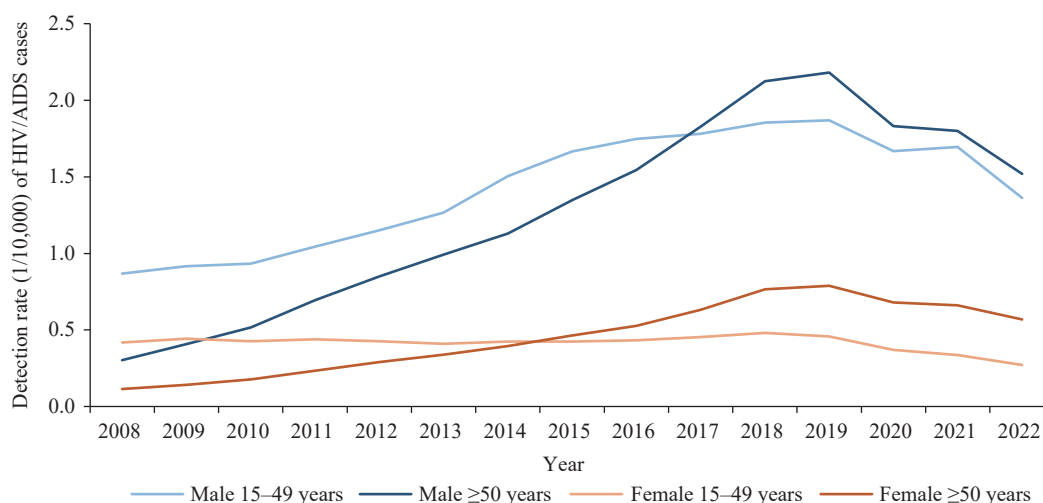

FIGURE 2. The trending change in the detection rate of HIV/AIDS cases in individuals aged 15–49 and ≥50 years old in China, 2010–2022.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.

TABLE 1. Annual percent change in detection rate of HIV/AIDS in individuals aged 15–49 and ≥50 years old in China, 2010–2022.

Age, years	AAPC, % (95% *CI*)	*t*	*P*	Year	APC, % (95% *CI*)	*t*	*P*
Male							
15–49	3.8 (0.8, 6.8)	2.5	0.013	2010–2015	12.8 (8.1, 17.6)	7.3	0.001
				2015–2019	3.2 (−4.4, 11.4)	1.0	0.343
				2019–2022	−8.9 (−16.6, −0.5)	−2.7	0.041
≥50	8.8 (7.2, 10.4)	11.2	<0.001	2010–2018	18.3 (16.1, 20.6)	20.5	<0.001
				2018–2022	−8.0 (−11.2, −4.6)	−5.4	0.001
Female							
15–49	−3.5 (−5.3, −1.7)	−3.7	<0.001	2010–2019	1 (−0.1, 2.2)	2.0	0.079
				2019–2022	−15.8 (−22.3, −8.7)	−4.9	0.001
≥50	9.9 (8.4, 11.4)	13.8	<0.001	2010–2018	19.2 (17.2, 21.4)	23.1	<0.001
				2018–2022	−6.7 (−9.6, −3.7)	−5.1	0.001

Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; AAPC=average annual percent change; APC= annual percent change; *CI*=confidence interval.

TABLE 2. Characteristics of newly reported HIV/AIDS cases aged 15–49 and ≥50 years in China, 2022 (*n*, %).

Characteristics	Male			Female		
	15–49 years (*n*=46,802)	≥50 years (*n*=37,358)	x^2	15–49 years (*n*=8,595)	≥50 years (*n*=14,498)	x^2
Ethnicity						
Han	39,965 (85.39)	33,655 (90.09)	422.2*	5,553 (64.61)	12,133 (83.69)	1,102.1*
Others	6,837 (14.61)	3,703 (9.91)		3,042 (35.39)	2,365 (16.31)	
Marital status						
Single	12,484 (26.67)	21,476 (57.49)		4,876 (56.73)	8,887 (61.30)	
Married or living with partner	27,959 (59.74)	3,208 (8.59)	23,465.9*	1,384 (16.10)	109 (0.75)	2,178.1*
Divorced or widowed	6,141 (13.12)	12,522 (33.52)		2,296 (26.71)	5,452 (37.61)	
Unknown	218 (0.47)	152 (0.42)		39 (0.45)	50 (0.34)	
Occupation						
Farming	12,856 (27.47)	24,475 (65.51)		4,273 (49.71)	9,720 (67.04)	
Housekeeping service or unemployment	11,666 (24.93)	5,142 (13.76)	12,284.7*	2,322 (27.02)	2,969 (20.48)	749.1*
Others	22,280 (47.60)	7,741 (20.72)		2,000 (23.27)	1,809 (12.48)	
Education						
Primary school or illiterate	6,988 (14.93)	21,734 (58.18)		3,687 (42.90)	10,407 (71.78)	
Junior high school	13,625 (29.11)	11,111 (29.74)	23,289.4*	3,164 (36.81)	3,275 (22.59)	2,259.1*
High school	9,619 (20.55)	3,199 (8.56)		1,069 (12.44)	654 (4.51)	
College and above	16,570 (35.40)	1,314 (3.52)		675 (7.85)	162 (1.12)	
Transmission route						
Heterosexual	22,448 (47.96)	32,516 (87.04)		8,365 (97.32)	1,4238 (98.21)	
Homosexual	23,463 (50.13)	4,125 (11.04)	14,632.7*	-	-	36.86*
Injecting drugs	287 (0.61)	86 (0.23)		47 (0.55)	21 (0.14)	
Others	604 (1.29)	631 (1.69)		183 (2.13)	239 (1.65)	
Site of diagnosis						
Hospital	26,048 (55.66)	26,997 (72.27)		5,279 (61.42)	9,484 (65.42)	
High-risk population screening	15,999 (34.18)	6,447 (17.26)	3,143.3*	2,341 (27.24)	3,656 (25.22)	42.8*
Others	4,755 (10.16)	3,914 (10.48)		975 (11.35)	1,358 (9.36)	
Regions						
North China	4,275 (9.13)	1,322 (3.54)		220 (2.56)	268 (1.85)	
Northeast	2,727 (5.83)	818 (2.19)		154 (1.79)	213 (1.47)	
East China	10,424 (22.27)	5,813 (15.56)	4,245.1*	1,048 (12.19)	1,799 (12.41)	476.4*
South Central	13,793 (29.47)	11,676 (31.25)		2,132 (24.81)	4,527 (31.22)	
Southwest	12,424 (26.55)	16,304 (43.64)		4,188 (48.73)	7,187 (49.57)	
Northwest	3,159 (6.75)	1,425 (3.81)		853 (9.92)	504 (3.48)	
CD4+T cells (cells/μL)						
0–199	11,890 (25.40)	13,171 (35.26)		2,041 (23.75)	4,351 (30.01)	
200–349	12,510 (26.73)	10,029 (26.85)		2,388 (27.78)	4,376 (30.18)	
350–500	8,965 (19.16)	4,832 (12.93)	2,295.7*	1,642 (19.10)	2,302 (15.88)	215.4*
501–	7,142 (15.26)	2,942 (7.88)		1,375 (16.00)	1,631 (11.25)	
Undetected	6,295 (13.45)	6,384 (17.09)		1,149 (13.37)	1,838 (12.68)	

Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.
* *P*<0.01.

transmission route for both age brackets, at 70.65% and 64.33%, respectively, as detailed in Table 2.

CONCLUSIONS

Our study revealed that the detection rates of HIV/AIDS among individuals aged 50 and older have surpassed those in the 15–49 age group in recent years in China. This aligns with research indicating that the proportion of PLWHA who are aged 50 years or older has been on an annual rise (5). Factors contributing to this trend include high-risk sexual behaviors and a deficit in HIV-related knowledge and awareness among this demographic (6). Consequently, the rising trend underscores the need for heightened attention and targeted interventions for the population aged 50 years and above.

The observed prevalence of newly identified HIV infections across two distinct age demographics exhibited an increasing trend prior to the year 2019, followed by a notable decline commencing in 2020. This pattern not only captures the ongoing dynamics of the epidemic but is also influenced by the enactment of comprehensive prevention and control tactics aimed at broadening diagnostic evaluations (7). These measures have contributed to the identification of a higher number of HIV-positive individuals. Moreover, the downward trend could be indicative of advancements in prevention and control efforts (3), as well as the consequences of intensified COVID-19 mitigation policies during the same timeframe. These policies, which curtailed movement and social gatherings, may have indirectly led to a reduction in high-risk behaviors (8).

In China, there are distinct variations in the transmission routes and regional distribution of HIV cases. Men aged between 15 and 49 years are at an elevated risk of contracting HIV through homosexual contact, whereas the primary transmission route for elderly men is CHC. Additionally, there is a rising trend in HIV/AIDS cases among women aged 50 years or older, which can be partly attributed to the fact that post-sterilization, older women may not feel the need to engage in contraceptive practices (9).

Moreover, the data reveals a significant proportion of HIV/AIDS cases with critically low CD4+ cell counts (below 200 cells/μL), indicating a substantial number of undiagnosed cases. This underscores the urgent need for intensifying efforts to identify and diagnose individuals living with HIV/AIDS.

This study has some limitations. The data from CRIMS were used in this study to conduct a macro-level analysis. However, we were unable to investigate the behavioral characteristics of PLWHA in-depth due to monitoring data limits.

In conclusion, there are differences in demographic characteristics and transmission routes between PLWHA aged over and under 50 years old. The proportion of HIV/AIDS cases among people aged ≥50 years showed an increasing trend. Further research is also required to identify the factors that contribute to the HIV epidemic in various age groups. We should focus on the elderly population and establish specific prevention and control measures for them.

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REFERENCES

1. UNAIDS. HIV and Aging. 2013. https://www.unaids.org/en/resources/documents/2013/20131101_JC2563_hiv-and-aging. [2023-7-20].
2. He N. Research progress in the epidemiology of HIV/AIDS in China. China CDC Wkly 2021;3(48):1022 – 30. http://dx.doi.org/10.46234/ccdcw2021.249.
3. Han MJ. Analysis of epidemic situation of AIDS in China and prospect of prevention and treatment. Chin J AIDS STD 2023;29(3):247 – 50. http://dx.doi.org/10.13419/j.cnki.aids.2023.03.01. (In Chinese).
4. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Statist Med 2000;19(3):335 – 51. http://dx.doi.org/10.1002/(SICI)1097-0258(20000215)19:3<335::AID-SIM336>3.0.
5. Wang YY, Yang Y, Chen C, Zhang L, Ng CH, Ungvari GS, et al. Older adults at high risk of HIV infection in China: a systematic review and meta-analysis of observational studies. PeerJ 2020;8:e9731. http://dx.doi.org/10.7717/PEERJ.9731.
6. Xing JN, Li YG, Tang WM, Guo W, Ding ZW, Ding GW, 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. http://dx.doi.org/10.1093/cid/ciu214.
7. Chen FF, Ma KF, Zhang XT, Ge L, Cai C, Qin QQ, et al. Analysis of sex ratio of newly reported people living with HIV/AIDS aged ≥50 years and infected through heterosexual contact in China, 2015–2019. Dis Surveill 2022;37(5):618 – 22. http://dx.doi.org/10.3784/jbjc.202201250018. (In Chinese).
8. Wang S, Yang J, Niu DD, Hou YS, Fei LP, Zhao HH, et al. Change of sexual behavior among men who have sex with men before, during and after COVID-19 pandemic in China: a cross-sectional study. BMC Infect Dis 2023;23(1):527. http://dx.doi.org/10.1186/s12879-023-08488-2.
9. Zablotsky D, Kennedy M. Risk factors and HIV transmission to midlife and older women: knowledge, options, and the initiation of safer sexual practices. J Acquir Immune Defic Syndr 2003;33(Suppl 2):S122 – 30. http://dx.doi.org/10.1097/00126334-200306012-00009.