

An Observational Study on HIV and Syphilis Rates and Associated Risk Factors Among Elderly Men in Wuxi, China

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Abstract

Background: Human immunodeficiency virus (HIV) remains a nationwide health problem in China, there were a reported 1,045,000 people living with HIV/Acquired Immune Deficiency Syndrome (AIDS) by the end of October 2020, and the number of individuals aged 50 years and older living with HIV has also increased over the past two decades.

Methods: A cross-sectional and 1:2 matched case-control studies were conducted from July to August 2016, in three community of Wuxi city, eastern China. A total of 1000 men aged 50 and over completed a face-to-face interview regarding their HIV-related knowledge and attitudes, as well as risk behaviors. All participants also provided a five-milliliter blood sample for syphilis and HIV testing.

Results: Among the 1,000 participants, the mean age was 64.7 ± 8.1 years. Less than half of the participants answered all HIV and sexually transmitted diseases (STDs)-related questions correctly (range 40.7%-63.9%). Younger men ($\chi^2=23.175$, $P<0.05$) with more education ($\chi^2=52.054$, $P<0.05$) were more knowledgeable about HIV compared to others. Less than 10% men knew where to get test for HIV, while only 2.1% had ever been tested. Serological testing showed that 20 participants were currently infected with syphilis and one person was tested positive for HIV antibody, however, none of them admitted having risky behaviors related to HIV/STDs. The 1:2 matched case-control indicated that only the AIDS-related attitudes were different between two groups ($\chi^2=8.726$, $P=0.013$), the conditional logistic regression analysis indicated that scores of AIDS health knowledge was the only significant prognostic factor for the infection ($HR=0.754$ (0.569-0.999), $P=0.049$).

Conclusions: The overall HIV/STDs-related knowledge among elderly men in Wuxi, China was low. Further research aimed at identifying how these factors impact their sexual decision making can shed valuable insight into further prevention program in this population.

Background

According to the Global human immunodeficiency virus & acquired immune deficiency syndrome (HIV & AIDS) statistics-2020 fact sheet [1], 38.0 (31.6–44.5) million people were living with HIV/AIDS worldwide and there were 1.7 million newly infected cases in 2019 [1]. HIV infected people are classified as adults and elderly people at the age of 50 worldwide [2]. The HIV prevalence amongst the elderly population has increased, while only a few studies highlighting the importance of the HIV epidemic in older age groups [3, 4]. It was estimated that there were more than 4.2 (4.0-4.5) million people aged 50 years and older living with HIV globally, with the highest burden in sub-Saharan Africa; of which there were approximately 2.5 (2.4–2.7) million infections among older adults [5]. In the European Union and European Economic Area, those aged 50 and older constituted 18.0% of new HIV diagnoses in 2018 [6], while in the United States, people aged 50 and older living with HIV accounted for approximately 47% of all diagnosed cases in 2016, around 1 in 6 HIV diagnoses ($N = 6640$, $N_{Men}=4769$) in 2017 were in this group [7].

Similar to Africa and Europe, HIV remains a nationwide health problem in China, where, by the end of October 2020, there were a reported 1,045,000 people living with HIV/AIDS, with 11,2000 newly infected cases [8, 9]. The number of individuals aged 50 years and older living with HIV has increased over the past two decades throughout China. From 2010 to 2019, reported by the elderly population, especially retired men over 60 years old, the number of cases rose from 4,751 to 28,763, with an increase rate of 500.0%, while new HIV infections also increased, from 64,108 to 151,250 [10]. As in the United States, heterosexual transmission is the most common transmission route amongst elderly populations in China, followed by homosexual transmission in some areas [11]. As seen from these epidemiological studies, HIV infection amongst the elderly population in China continues to spread, with increasing prevalence over the last five years. Few studies in China exist, however, which aim to understand factors leading to this ongoing transmission.

Wuxi is a city located in Jiangsu Province in Eastern China with a total population of 6.57 million people [12]. By the end of 2018, 3,360 people were reported to be living with HIV/AIDS in the city the first elderly case of HIV was reported in 2004 and by 2018 [13], more than a fourth amongst the reported cases of HIV/AIDS were those over 50 years old (843/3,360 cases). More so, the average age of people living with HIV infection in 2012 was 41.8 years old, indicating that HIV amongst the elderly will likely be on the rise in the coming years [14]. Though the elderly could be considered as a group at risk for HIV infection due to their continued transmission and increasing prevalence, little literature exists which examines the risky taking behaviors and general HIV awareness amongst this group. Therefore, the aim of our study was to investigate HIV and sexually transmitted diseases (STDs)-related knowledge, attitudes, and risky behaviors among men aged 50 and older in Wuxi city, in order to provide insight for HIV prevention and control among the elderly.

Methods

Study design and participants

A cross-sectional study was conducted from July to August 2016. Multi-stage, random sampling was conducted in three communities in Wuxi City with the highest HIV prevalence. Male residents aged 50 years or older were recruited from one to two administrative villages and one to two natural villages, which were randomized.

Upon completion of the cross-sectional study, a 1:2 matched case-control study was conducted to analyze the risk factors associated with syphilis or HIV infection. Participants whom were currently infected with syphilis or HIV positive were chosen as cases, while the control group was randomly selected using a 1:2 ratio, matching by age (± 2 years) among the remaining participants.

The Chinese Center for Disease Control and Prevention (China CDC) of Wuxi approved the study protocol. The objectives and the procedure of the study, the potential risks and benefits of participating in the study

were given to potential participants during the recruitment of study subjects. Written informed consents were obtained from all subjects participated in the survey.

Data collection

All participants were asked to complete a survey (Table 2), which included questions on socio-demographic characteristics (age, marital status, place of residence, education), HIV/AIDS-related knowledge (consisting of eight questions adapted from China's National HIV Surveillance Surveys) [15, 16], attitudes (six questions on views and concerns about AIDS, such as "Is AIDS far away from you?", "Have you ever consulted a doctor or an expert on AIDS/STDs?" etc.) and risk-behaviors ("Whether having sex with female sex workers?", "Whether ever having injected drugs?" etc.). Trained investigators (dozens of staff from Wuxi CDC) conducted the anonymous and voluntary, face-to-face survey.

Eight questions were used to estimate the level of HIV-related knowledge, with one point awarded for each correct response, while wrong answers or unknown responses were given a score of zero. Those who scored six or more points were categorized as "HIV aware" [17]. The awareness rate was calculated as the number of participants considered aware divided by the total sample size (1,000).

All participants also provided a five-milliliter blood sample for syphilis and HIV testing. If a participant tested both toluidine red unheated serum test (TRUST) and enzyme linked immune—S0tbent assay (ELISA) positive, he was defined as syphilis positive. HIV infection was defined as positive on both ELISA screening and Western Blot (WB) confirmation test [18].

Statistical Analysis

Data was double-recorded and entered using Epi Data 3.0 (The Epi data Association, Odense, Denmark). All statistical analysis was carried out with SPSS 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). The socio-demographic characteristics were described using absolute numbers or percentage. Chi square tests or t-tests were used to assess the differences in exposure factors between the cases and the controls. Paired t-test, Chi square test and Conditional Logistic Regression were also used in the 1:2 matched case-control study. A *P*-value of less than 0.05 was considered as statistically significant.

Results

Socio-demographic Characteristics of the Study Participants

1,000 male participants were included in the final study. Table 1 summarizes the socio-demographic characteristics of all participants. The mean age was 64.7 ± 8.1 (range 50–94 years), and the median age was 64 years (Inter Quartile Range [IQR]: 59,70). Most of the participants were aged 60–69 years (43.5%, *n* = 435), with 42 (4.2%) people aged 80 years and over. The majority of the participants (82.2%, *n* = 822)

were married and 76.8% (n = 768) were rural residents. More than four-fifths of the participants (n = 872, 87.2%) had at most a junior high school level of education (Table 1).

Table 1
Socio-demographic Characteristics of Males aged 50 years and older from Wuxi, Jiangsu Province, Eastern China

Demographic variables	Participants (N)	Proportion (%)
Age		
50–59	293	29.3
60–69	435	43.5
70–79	230	23.0
80 and older	42	4.2
Marital status		
Unmarried	14	1.4
Married	822	82.2
Cohabitation	119	11.9
Divorced or widowed	45	4.5
Place of residence		
Towns	232	23.2
Rural	768	76.8
Education		
Illiterate or primary school	435	43.5
Junior high school	437	43.7
High school or higher	128	12.8

HIV/AIDS-Related knowledge

There were eight questions assessing HIV/AIDS-related knowledge, with scores ranging from zero to eight points. 190 (19%) people answered all eight questions correctly, while 217 (21.7%) did not answer a single question correctly. Most participants knew that it was possible to be HIV infected via an HIV-positive blood transfusion (n = 639, 63.9%) and from sharing syringes with HIV infected people (n = 636, 63.6%), while fewer (n = 407, 40.7%) knew that “mosquito bites won’t spread AIDS” (Table 2).

Table 2

Answers to HIV^{*}/AIDS⁺-related knowledge of Males aged 50 years and older from Wuxi, Jiangsu Province, Eastern China

8 questions about HIV/AIDS related knowledge	Correct n (%)	Incorrect n (%)	Unknown n (%)
Is it possible to get AIDS with the input of blood or blood products contaminated by HIV virus?	639 (63.9)	56 (5.6)	305 (30.5)
Is it possible to get AIDS if sharing syringes with HIV infected people?	636 (63.6)	43 (4.3)	321 (32.1)
Can someone infected with HIV look like a healthy person?	594 (59.4)	26 (2.6)	380 (38.0)
Can you get HIV by eating with an infected person or a patient?	572 (57.2)	86 (8.6)	342 (34.2)
Is it possible for a baby born with HIV by a HIV-positive woman?	557 (55.7)	64 (6.4)	379 (37.9)
Can people reduce the risk of HIV infection if they use a condom during sex?	567 (56.7)	61 (6.1)	372 (37.2)
Can people reduce the risk of HIV infection if they sex with only one partner?	531 (53.1)	78 (7.8)	391 (39.1)
Can people get AIDS from mosquito or other insect bites?	407 (40.7)	184 (18.4)	409 (40.9)
*HIV: Human immunodeficiency virus; ⁺ AIDS: Acquired immune deficiency syndrome.			

Less than half (48.9%) of all participants were considered to be aware of HIV/AIDS (range 40.7%-63.9%). The awareness rate decreased with increasing age ($\chi^2 = 23.175$, $P < 0.05$), which was 57.3% in the 50–59 age group and 28.6% in those aged over 80 years old. Less education was also negatively correlated with HIV awareness ($\chi^2 = 52.054$, $P < 0.05$) (Table 3).

Table 3

Awareness of HIV^{*}/AIDS⁺-related knowledge of Males aged 50 years and older from Wuxi, Jiangsu Province, Eastern China

Demographic variables	Awareness rate (%)	Opposite rate (%)	OR	χ^2	<i>P</i>
Age					
50-59	57.3	42.7			
60-69	50.1	49.9		23.175	<0.001*
70-79	39.6	60.4			
80 and older	28.6	71.4			
Place of residence					
Towns	46.6	53.4		0.667	0.414
Rural	49.6	50.4			
Education					
Illiterate or primary school	37.2	62.8		52.054	<0.001*
Junior high school	54.2	45.8			
High school or higher	70.3	29.7			
Marital status					
Unmarried	50.0	50.0	1.07		0.200
Married	48.1	51.9	1.03		0.291
Cohabitation	55.5	44.5	1.19		0.779
Divorced or widowed	46.7	53.3	1.00		0.097
Total	48.9	51.1			
* <i>P</i> <0.05					

HIV/AIDS-Related Attitudes

Table 4 highlights the generally low HIV and STD-related attitudes of participants in the study. Nearly two-thirds of the participants (n = 694, 69.4%) believed they would perceive a low risk of acquiring HIV, but only a small fraction (n = 80, 8.0%) said they would pay attention to AIDS prevention messaging and even fewer (n = 20, 2.0%), reported they were willing to work with an infected person. Less than 10% (n = 96,

9.6%) of participants knew where to get tested for HIV, only one-fifth of participants had ever been tested (n = 21, 2.1%), and 3% (n = 32) had ever consulted a doctor or expert on AIDS/STDs (Table S8).

Table 4
Relationship between self-reported risk behaviors and HIV and STD test results of Males aged 50 years and older from Wuxi, Jiangsu Province, Eastern China

Self-reported high-risk behavior	Diagnostic Test		Total
	Positive	Negative	
Yes	0(A)	13(B)	13(R ₁)
No or Refuse	21(C)	966(D)	987(R ₂)
Total	21(C ₁)	979(C ₂)	1000(N)

AIDS/STDs-Related Behaviors

Only a handful of study participants mentioned engaging in high-risk behaviors. Eight participants (0.8%) reported having previously had sexual intercourse with Female Sex Workers (FSWs), two participants (0.2%) reporting have anal sex with a male partner, four (0.4%) had previously been diagnosed with an STD, and only one (0.1%) reported ever having injected drugs (Table S8). Because the drug user also had sex with FSWs and had been diagnosed with STDs, a total of 13 people self-reported various HIV/AIDS-related risky behaviors among the participants.

HIV and Syphilis Testing

Based on the results of the TRUST and ELISA tests, 20 (2.0%) participants were currently infected with syphilis, while 25 (2.5%) were ELISA positive only, indicating that they had previously been infected with syphilis. More individuals aged 70 years and older (n = 8, 3.5%), residing in towns (n = 22, 2.2%) were currently infected with syphilis. There was no significant difference in the positive rate between participants of varying educational levels. Additionally, only 1 individual (0.1%) tested positive for HIV.

13 participants whom reported risky sexually behaviors (Table 4) were all tested negative for HIV and STDs. The relationship between the self-reported risk behaviors and the results of the diagnostic tests are highlighted in Table 6. The true positive rate of self-reported was only 2.3% $(A + 0.5 / A + C + 1) * 100\%$, true negative rate of self-reported was 98.6% $(D + 0.5 / B + D + 1) * 100\%$, missing report rate (false negative rate) was 97.7% $(C + 0.5 / A + C + 1) * 100\%$ (add 0.5 for each cell in Table 6 for the cell A is 0).

Risk Factors of HIV/STDs Infections

The results of the matched case-control study can be found in Table S8. The case group was composed of 21 individuals, consisting of the twenty participants currently infected with syphilis and one whom

tested HIV positive. The control group was composed of 42 individuals, randomly selected from the remaining participant, and matched on age. AIDS related attitudes were associated with HIV or syphilis infection ($\chi^2 = 8.726$, $P = 0.013$), while demographic characteristics, knowledge and other factors had no relationship with risky behaviors (Table S8). The multivariate logistic regression analysis indicated that scores of AIDS health knowledge was the only significant prognostic factor for the HIV or syphilis infection ($HR = 0.754$ (0.569–0.999), $P = 0.049$).

Discussion

This study serves as one of the first analyses of HIV and syphilis prevalence and associated factors amongst older men in Wuxi city, China. With ongoing transmission and increasing rates of HIV amongst adults aged 50 and older in China, studies such as ours can shed light on current trends and related risk behaviors of this group. In our study, less than half of the participants were considered to be aware of HIV/AIDS, which was lower than HIV awareness rates reported amongst younger participants throughout China [19, 20]. Previous research has suggested that lack of awareness and associated low-risk perception can lead to higher risky behaviors, such as inconsistent condom use. While only one individual tested positive for HIV and 0.2% of the men were currently infected with syphilis in this study, the general lack of HIV awareness amongst participants could lead to the potential spread of both HIV and STDs throughout the city. Additionally, those with less education were also negatively associated with HIV knowledge. A study amongst 866 rural people living with HIV in Henan, Anhui, and Yunnan provinces in China found that older individuals had fewer chances to receive formal education, particularly those from rural China. Subsequently, this may impact their ability to receive and understand current HIV messaging. There may also be insufficient coverage of existing health education programs or inadequate intervention measures specifically targeting older populations. Tailoring programs like folk performances, tour groups and other ways could be used to expand the influence of HIV/AIDS publicity and strengthen health education for older adults [21]. More so, though few men in this study reported anal sex with a man, homosexual transmission is becoming a main route of HIV transmission amongst elderly men in China [22]. This, coupled with ongoing heterosexual transmission, puts older adults at increased risk for both acquiring and transmitting HIV and related STDs. Previous research has shown that elderly males were sometimes unwilling to use condoms due to their belief that condoms reduce their already declining sexual function, which can increase their exposure to diseases [23]. Understanding and addressing the sexual desires of older adults can promote better uptake of interventions and reduce associated risk behaviors [22]. Further analysis which examines how this lack of HIV knowledge and awareness may be impacting sexual decision making, such as condom use and number of sexual partners, should be explored in order to better develop interventions for this group.

The results should be considered in light of limitations of the study. First, the initial study was cross-sectional in nature and as such, causality could not be assumed. Additionally, it is likely that reporting or desirability bias impacted the results of the survey. None of those tested positive for syphilis and HIV infection in this study self-reported high-risk behaviors. However, of those self-reporting high-risk

behaviors, none tested positive for HIV or syphilis. It could be that participants answered questions in ways they felt the investigators would approve. To reduce these biases, trained investigators delivered the survey and promoted the anonymity of responses.

This study is the first large-scale, community-based HIV/AIDS survey among elderly adults in Jiangsu province, using a combination of survey results and confirmatory, laboratory testing. It provides an important basis for understanding the current situation of AIDS/STDs in the elderly population and suggests that the sexual health of the elderly is a public health problem that cannot be ignored. Further efforts aimed at promoting HIV and STD education amongst these adults is needed, while further research aimed at identifying how these factors impact their sexual decision making can shed valuable insight into prevention programming in this population.

Conclusions

According to the results of the matched case-control study, those whom would refuse to work with an HIV positive individual were more likely to engage in high-risk sexual behaviors. The conditional logistic regression analysis indicated that scores of the AIDS health knowledge was the only significant factor for the infection. This could generally be associated with a lack of knowledge and awareness about HIV, which as previously discussed, can lead to increased risk for HIV and STDs. No other factors were found to be associated with HIV or syphilis infection.

Abbreviations

HIV/AIDS: human immunodeficiency virus/acquired immune deficiency syndrome; STDs: sexually transmitted diseases; China CDC: Chinese Center for Disease Control and Prevention; TRUST: toluidine red unheated serum test; ELISA: enzyme linked immune—S0tbent assay; WB: Western Blot; IQR: interquartile range.

Declarations

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Authors' contributions

X.Z and X.J.M are the correspondence authors of this article and they also acted as the submission's guarantors. X.Z conceived and designed the study. Y.C collected and analyzed the data. Y.N.B, M.J.C and J.G assisted to collect the data. Y.C, X.Z and X.J.M interpreted the data and drafted or wrote the manuscript. Y.C, Y.N.B, Z.Y.W, S.R, M.J.C, J.G, X.Z and X.J.M involved in the critical revision of the

manuscript for important intellectual content and approval of the final version. Y.C, and X.Z obtained funding. All authors approved the final version of the manuscript.

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Availability of data and materials

The data supporting the conclusions of this article are included in the article and additional files. But the datasets generated during the current study are not publicly available due to local legislation, therefore they are partially available from the corresponding author on reasonable request (Email: ntzhuang@163.com).

Ethics approval and consent to participate

Wuxi Center for Disease Control and Prevention approved the study protocol (approval number: WXCDCLL2016005). The objectives and the procedure of the study, the potential risks and benefits of participating in the study were given to potential participants during the recruitment of study subjects. Written informed consents were obtained from all subjects participated in the survey.

Consent for publication

Not applicable.

Competing interests

All authors declare that they have no conflict of interest.

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