Epidemiological characteristics of HIV infection among college students in Nanjing, China: a cross-sectional survey

Wei Li, Jinjin Chu, Zhengping Zhu, Xin Li, You Ge, Yan He, Qian Ni, Taha Musa, Xiaoshan Li, Pingmin Wei

ABSTRACT

Objective This study aimed to investigate the epidemiological characteristics and HIV/AIDS-related knowledge, attitudes and practice (KAP) among HIV-positive college students.

Design A cross-sectional study.

Setting Five districts of Nanjing, China.

Participants A total of 156 college students with newly diagnosed HIV infection between September 2015 and July 2017.

Main outcome measures Social-demographic characteristics, mode of HIV acquisition, infection of sexually transmitted diseases, risky sexual behaviours and HIV/AIDS-related KAP were collected by a face-to-face questionnaire administered by trained interviewers.

Results About 98.7% (154/156) of HIV-positive college students in our study were men, and 96.1% (148/154) of them were infected by sexual intercourse with men. More than half (52.5%, 82/156) of participants were freshmen or sophomores. Nearly 30% (44/154) of male students did not realise the severe status of the HIV/AIDS epidemic among students who are men who have sex with men (MSM). More than four-fifths of male students did not know if their male regular (83.0%, 93/112) or casual (95.9%, 94/98) sexual partners were HIV-negative, while less than half of them had high-risk perceptions towards HIV infection from male regular and occasional sexual partners. Approximately one-half and four-fifths of male students had more than two regular (54.5%, 61/112) and occasional (79.6%, 78/98) partners during lifetime, respectively. However, only 62.5% (70/112) and 66.3% (65/98) of male students used condoms consistently during sexual intercourse with regular and casual partners, respectively. Geosocial networking apps have become the most dominant way for male students seeking sexual partners.

Conclusions This study reported a low level of HIV/AIDS-related knowledge, a high level of exposure to risky sexual behaviours and some valuable epidemiological characteristics among HIV-positive college students, which highlighted the importance of carrying out HIV/AIDS prevention education and risk warning education early and timely towards college students on campus.

INTRODUCTION

Approximately 37.9 million people were living with HIV/AIDS at the end of 2018 worldwide, and 1.7 million people became newly infected with HIV in 2018. Of 5000 individuals who were newly infected cases with HIV each day in 2018, around 32% were young people aged 15–24 years old. The UNICEF reported that the estimated number of adolescents (10–19 years) living with HIV/AIDS has increased by 480,000 from 2000 to 2018 globally, among whom 380,000 were male adolescents. About 740,000 adolescents could become infected with HIV between 2016 and 2030 due to the low level of knowledge regarding HIV/AIDS and high-risk sexual behaviours if current prevention progress is not optimised. In recent years, the number of people living with HIV/AIDS has been increased sharply among young people in China, especially in college students. According to the National Centre for AIDS/STD Control and Prevention, China Centers for Disease Control and Prevention (CDC), the number of newly diagnosed college students has seen an annual growth rate ranging from 30% to 50% over the past several years, and nearly 10 college students were infected with HIV each day. From 2013 to 2017, 12,037 new cases of HIV infection among young students were reported in China, and 97.7% of them were men. In 2017, the newly diagnosed students reached 3,077, which was tenfold greater than

Strengths and limitations of this study

- The first study investigating the HIV/AIDS-related knowledge, attitudes and practice (KAP) among HIV-positive college students in China.
- Face-to-face questionnaires administered by trained interviewers in a separate private room to ensure privacy and confidentiality for the respondents and achieve satisfactory response rates.
- Possible overestimation of the HIV/AIDS-related knowledge levels due to the postdiagnostic measures of HIV/AIDS-related KAP.
- A cross-sectional study with small sample size and short time frame may not be generalisable to other regions or populations.

Correspondence to Dr Pingmin Wei; mwp1963@126.com
than 10 years ago. The proportion of men who have sex with men (MSM) among students was higher than that of adolescents outside school. Among 38 million university students in China, approximately 1.7 million are MSM aged 18–22 years. Therefore, the prevalence of HIV infection among college students has become a worrisome issue and prevention efforts are needed urgently.

As an important educational centre, there are 53 institutions of higher education and nearly 780,000 college students in Nanjing city. In recent years, students have captured considerable public health attention as an increasing number of them have been detected with HIV. Over 200 college students were diagnosed in Nanjing between 2002 and 2014. Our previous study reported that a total of 319 young students were diagnosed with HIV in Nanjing between 2011 and 2016 and and the average growth rate was 33.9% during the 6 years. The proportion of HIV-infected MSM among young student cases (93.4%) was higher than that of adolescents outside school (77.8%). However, we have little knowledge of the epidemiological characteristics and HIV/AIDS-related knowledge, attitudes and practice (KAP) among HIV-positive college students in Nanjing, China. There is a critical need to study the detailed characteristics of this population.

**Significance and objectives of the study**

College students in China already face a number of challenges, and now HIV has been added to this list. Understanding the characteristics of HIV-infected college students could assist in identifying effective interventions to deal with the HIV epidemic on campus. In addition, evaluating HIV/AIDS-related KAP among HIV-positive college students rather than young students in general, could help retrospect the process of infection in college students and provide more useful information for HIV prevention on this population. Due to the critical gap between the increasing prevalence of HIV and the limited workforce in CDC in China, the data collected through routine surveillance systems were ineffective to provide sufficient information about the characteristics of HIV-infected college students. Therefore, in this study, we conducted a cross-sectional survey by a structured questionnaire, aiming to better understand the epidemiological characteristics and HIV/AIDS-related KAP among HIV-positive college students.

**METHODS**

**Study area and period**

This study was conducted from 1 September 2015, to 31 July 2017, in five counties (including Gulou, Xuanwu, Jiangning, Qinhuai and Qixia) of Nanjing, Jiangsu province, China. Of 53 institutions of higher education in Nanjing city, 45 are located in these five districts. Based on the unpublished data from Nanjing CDC, the number of HIV-infected students in these five districts accounted for over 90% of the total number of HIV-positive students in Nanjing over the past few years.

**Study participants**

All newly diagnosed HIV-positive individuals were recruited consecutively if they met the following criteria: (1) HIV-positive cases screened by HIV-1/HIV-2 ELISA and confirmed by HIV-1 Western blot in Nanjing CDC between 1 September 2015 and 31 July 2017; (2) self-reported as undergraduates or postgraduates and was confirmed by the student cards/identification card/residence permit; (3) aged 18 years and above; (4) agreed to participate in this study with verbal or written informed consents. Eventually, 156 HIV-positive students were enrolled in the survey.

**Study instrument**

Data were collected using a structured interviewer-administered questionnaire. This questionnaire was developed based on the Guidelines of intervention work for the prevention of HIV/AIDS among MSM and heterosexual in China (issued by National Center for AIDS/STD Control and Prevention, China CDC) and took the characteristics of the young students into consideration. In our presurvey, this questionnaire showed high reliability and good internal consistency in measuring the HIV/AIDS-related KAP among college students (Cronbach’s α is 0.762 and Kaiser-Meyer-Olkin is 0.843).

Three categories of indicators, including socio-demographic characteristics, information of infection and HIV/AIDS-related KAP, were collected. Socio-demographic indicators included gender, age, ethnicity, domicile, educational institution and year in college. Information on infection was consisted of the mode of HIV acquisition and detection, and the self-reported infection of sexually transmitted diseases (STDs). HIV/AIDS-related knowledge was measured by eight items, which were specially developed for college students by the National Center for AIDS/STD Control and Prevention, China CDC. For each item, the correct answer (‘yes’) was scored 1, with the wrong answer (‘no’ or ‘unknown’) scored as 0. The total score of the HIV/AIDS-related knowledge was 8, with a higher score indicating a higher level of HIV/AIDS-related knowledge. Attitudes regarding HIV/AIDS prevention were measured by two questions, including whether the respondents knew the HIV-infection status of their sexual partners and whether or not they were worried about being infected with diseases from sexual partners. Sexual behaviour indicators included the types of sexual partners (eg, male and female regular sexual partner, male and female casual sexual partner), the way to seek sexual partners, the frequency of sexual behaviours and condom usage (online supplementary questionnaire).

**Data collection**

The interview was conducted at the first follow-up after the confirmation of HIV infection. Data were collected
through face-to-face questionnaire administered by trained staff who have long been engaged in HIV/AIDS prevention and control in each district CDC. All investigators were trained for questionnaire investigation and data collection to reduce information bias. The interview was conducted in a separate private room to protect the privacy of the respondents. Each interview took approximately 20–40 min.

**Patient and public involvement**

Patients were involved in the questionnaire investigation. The Nanjing CDC was involved in the study design. The questionnaire investigation was conducted by staff from district CDCs of Nanjing in a separate private room located in each district CDC.

**Statistical analysis**

Data analysis was performed using SPSS V.24.0 for Windows. Quantitative data were calculated as means±SD, and qualitative data were presented by absolute number and percentage (n (%)).

**RESULTS**

**Socio-demographic and infection characteristics**

From 1 September 2015 to 31 July 2017, a total of 159 HIV-infected college students were confirmed in Nanjing. One male case declined to participate in the study, and another two patients (one man and one woman) did not belong to our survey area (five counties), resulting in 156 individuals enrolled in our study. The mean age of the 156 participants was 21.3±2.3 years (range 18–33). The majority of participants (98.7%, 154/156) were men, and only 1.3% (2/156) were women. Almost all (96.1%, 148/154) of male students were infected through sexual intercourse with men. The majority of participants were sophomore students (37.8%, 59/156), whereas freshmen, junior, senior and postgraduate students accounted for 14.7% (23/156), 17.3% (27/156), 19.9% (31/156) and 10.3% (16/156), respectively. Only 19.2% (30/156) of students were natives, while 22.4% (35/156) and 58.3% (91/156) were migrants from other cities in Jiangsu and other provinces, respectively. The proportion of active detection after high-risk behaviours accounted for 32.1% (50), while 67.9% (106) was discovered by passive detection. A total of 40 (25.6%) participants had self-reported STDs, including 17 (10.9%) syphilis, 17 (10.9%) condyloma acuminate, 4 (2.6%) gonorrhoea and 2 (1.3%) genital herpes (table 1).

**The level of knowledge regarding HIV/AIDS among HIV-infected male students**

The overall mean score of knowledge regarding HIV/AIDS among male students was 6.7±0.1. The accuracy of responses for the eight items ranged from 67.5% to 96.8%, with four items below 80%. Fifty (32.5%) participants did not know that the new-type drugs (e.g., methamphetamine, ecstasy, ketamine etc.) can increase HIV infection, and 44 (28.8%) individuals did not realise the severe status of HIV/AIDS epidemic among MSM in colleges in China (At present, the HIV/AIDS epidemic among young students in China is growing rapidly, and MSM are primarily afflicted, followed by heterosexual individuals). In addition, 24.0% (37) of individuals did...
not know that HIV/AIDS is one of the serious and incurable diseases, and 22.1% (34) of subjects did not know that HIV/AIDS patients have equal rights for marriage, employment and education (online supplementary table S1).

**Risk perceptions towards HIV infection among HIV-infected male students**

Among the 154 HIV-positive male students, 112 (72.7%), 98 (63.6%), 13 (8.4%) and 9 (5.8%) respondents reported having sexual intercourse with male regular, male casual, female regular and female casual partners, respectively. The proportions of participants knowing that their sexual partner had been infected with HIV were extremely low (table 2). Among these respondents, only a low proportion of individuals reported that they were worried about being infected with diseases from partners (table 2). The predominant reason for not worrying about being infected with diseases was that they did not realise the potential risk (figure 1).

**Sexual behaviors among HIV-infected male students**

One hundred and forty-five male students reported on the experience of the initial sexual intercourse. The mean age for the initial experience of sexual intercourse was 19.1±2.0 years (range 12–33), and 37.7% (59/145) was before 18 years old. Four-fifths (80.7%) of the respondents reported that the partner of first sexual intercourse was man, and 37.8% (55/145) did not use condoms during the initial sexual intercourse.

Of respondents who have had male regular and casual partners, 54.5% (61/112) and 79.6% (78/98) had more than two sexual partners during lifetime, respectively. However, the proportions of male students who had intercourse over two times per month with male regular and casual partners were 61.6% (59/112) and 30.6% (30/98), respectively. However, the proportions of using condoms consistently during sexual intercourse with partners were low. The predominant reason for not using condoms was not realising the necessity of using condoms in sexual intercourse (figure 2). Geosocial networking (GSN) apps have become the primary way for students to seek sexual partners (table 3).

**DISCUSSIONS**

The severity of the HIV/AIDS epidemic among college students has captured increasing attention of the Chinese government. Several interventions, including expanding the publicity of HIV/AIDS-related knowledge, sex and reproductive health education, making HIV testing more accessible on campuses, and offering adolescent peer education programmes on HIV/AIDS, have been taken to address the HIV epidemic on campus. However, the current interventions for preventing HIV/AIDS are
not provided in all universities and are implemented ineffectively.3 Sex education programmes are not well-implemented among a substantial proportion of nearly 2800 universities in China, and only a small number of colleges made HIV testing more accessible on campus. Thus, how to implement these strategies effectively has become critical for HIV/AIDS prevention and control among college students. In this study, for the first time, we described the epidemiological characteristics of HIV infection among HIV-positive college students and explored the potential factors that underlying the increasing HIV infection in students.

Previous studies reported that college students had a high level of HIV/AIDS-related knowledge as they were highly educated.21 22 However, in this study, we found that there was still some lack of knowledge about HIV/AIDS, since the accuracy rates of half of HIV/AIDS-related questions were below 80% among HIV-positive male students. Specifically, a considerable proportion of individuals did not know the serious status of HIV/AIDS epidemic among students who are MSM. If college students did not receive comprehensive sex education before sexually active, they would be highly vulnerable to HIV when they started having sexual intercourse. Because

Table 3  Characteristics of sexual behaviours among 154 HIV-positive male students

| Characteristics                             | Male regular partners (112 respondents), N (%) | Male casual partners (98 respondents), N (%) | Female regular partners (13 respondents), N (%) | Female casual partners (9 respondents), N (%) |
|---------------------------------------------|-----------------------------------------------|---------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| The numbers of sexual partners              |                                               |                                             |                                               |                                               |
| 1                                           | 51 (45.5)                                     | 20 (20.4)                                   | 13 (100.0)                                   | 3 (33.3)                                      |
| 2–5                                         | 60 (53.6)                                     | 65 (66.3)                                   | 0 (0.0)                                      | 6 (66.6)                                      |
| ≥6                                          | 1 (0.9)                                       | 13 (13.3)                                   | 0 (0.0)                                      | 0 (0.0)                                      |
| The way to seek sexual partners              |                                               |                                             |                                               |                                               |
| Geosocial networking apps                   | 92 (82.1)                                     | 89 (90.8)                                   | 1 (7.7)                                      | 4 (44.4)                                      |
| Students or friends                         | 17 (15.2)                                     | 6 (6.1)                                     | 12 (92.3)                                    | 2 (22.2)                                      |
| Others                                      | 3 (26.8)                                      | 3 (3.1)                                     | 0 (0.0)                                      | 3 (33.3)                                      |
| Frequency of intercourse (times per month)   |                                               |                                             |                                               |                                               |
| 1                                           | 43 (38.4)                                     | 68 (69.4)                                   | 9 (69.2)                                     | 7 (77.8)                                      |
| 2–5                                         | 52 (46.4)                                     | 28 (28.6)                                   | 4 (30.8)                                     | 2 (22.2)                                      |
| ≥6                                          | 7 (6.3)                                       | 2 (2.0)                                     | 0 (0.0)                                      | 0 (0.0)                                      |
| Condom usage                                |                                               |                                             |                                               |                                               |
| Consistently                                | 70 (62.5)                                     | 65 (66.3)                                   | 4 (30.8)                                     | 4 (44.4)                                      |
| Sometimes                                   | 31 (27.7)                                     | 19 (19.4)                                   | 6 (46.2)                                     | 3 (33.3)                                      |
| Rarely                                      | 11 (9.8)                                      | 14 (14.3)                                   | 3 (23.1)                                     | 2 (22.2)                                      |
the competition for the college entrance examination is
fierce in China, precollege education is mainly focused
on scholarly studies with minimal sex education. For
many college freshmen, knowledge about HIV/AIDS,
STDs and sexual health are extremely limited, and they do
not know the serious status of the HIV/AIDS epidemic
among young students either. Some students have had
risky sexual behaviours before they received adequate
awareness of disease prevention. Thus, comprehensive
HIV/AIDS and sex education should be carried out early
and timely to improve the level of HIV/AIDS-related
knowledge among students. Not only educators in the
schools but also parents in the families should take on
the responsibility for fostering an open environment for
education and awareness on HIV/AIDS for students.
Meanwhile, peer-education also has the potential to
improve awareness and enhance students’ motivation for
HIV protection.

After entering university, students have increased
exposure to various sexual partners without parents’
supervision, and tend to have sexual intercourse more
frequently with multiple sexual partners as compared
with before attending university. Some students with
limited knowledge and awareness on sex education might
be exposed to frequent unprotected sexual behaviours.
Unfortunately, our findings revealed that a large number
of male students did not know if their sexual partners were
HIV-positive people and never realised that they could
be infected with diseases through their sexual partners.
The low level of risk perceptions towards HIV infection
among male students might be a crucial factor for their
risky sexual behaviour. Thus, there is a need to strengthen
the warning education about risky sexual behaviours for
college students. Furthermore, HIV infection presented
in all grades of colleges in our study, indicating that the
risk-warning education should be informed throughout
the college stage. However, at present, some universities
in China are unable to disseminate HIV/AIDS-related
knowledge and implement sex education with an open
and accepting attitude. Thus, college administrators
must create an open environment where sex education
can be frequently accessed by students and awareness on
HIV/AIDS can be sufficiently improved. Simultaneously,
education sectors need to work together with public
health professionals and student organisations to conduct
education campaigns in a more engaging way.

The high-risk behaviours, for instance, bisexual inter-
courses, multiple sex partners, high frequency of inter-
course and rare usage of condoms among college students
in Nanjing were similar to those reported in non-infected
students. We found that the rate of active HIV test was
low, probably due to the ongoing impact of stigma and
discrimination associated with HIV infection. Across 19
countries with available data, about 20% of people living
with HIV avoided going to a clinic or hospital for HIV
testing, treatment and prevention services, because they
worried about stigma or discrimination related to their
HIV status. The small proportion of active detection
among students also indicated the lack of self-motivation
for HIV testing and highlighted the importance of readily
accessible means of testing on campus. Some commu-
nity organisations have provided on-site HIV testing and
anonymous HIV urine-testing services in universities, which
should be implemented nationwide.

A recent study reported that the use of GSN apps was
associated with higher HIV incidence among MSM in
China. In this study, we found that approximately 82.1%
and 90.8% of male students used GSN Apps to seek the
male regular and casual partners, suggesting that the
GSN apps might also play an increasingly critical role in
promoting the spread of HIV on campus, which was in
line with other studies in USA and Europe. Yang et al
reported that several GSN apps including Blued, Aloha
and Zank were used widely for recognising sexual partners
among Chinese MSM undergraduates. Unfortunately,
many GSN apps have not played a corresponding role in disseminating knowledge regarding HIV/AIDS.
The other issue among college students was the coinfection
of HIV and STDs. The survey showed that the prevalence
of syphilis was posing a sharp increase among young
Chinese MSM. On the one hand, multiple infection of
STDs, especially syphilis and condyloma acuminate infec-
tion, may increase HIV-1 RNA levels, enhancing the trans-
missibility of HIV-1 among college students. On the
other hand, HIV-1 may affect the clinical presentation,
treatment outcome and progression of STDs. Therefore,
both the measures of STDs prevention and treatment
these HIV-positive individuals should be conducted
on campus simultaneously.

Our study has some limitations. First, selection bias may
exist as some HIV-positive college students concealed
that they were attending colleges for the consideration
of privacy. Thus, our data may not be fully representative
of the epidemiological characteristics of HIV infection
among college students in Nanjing. Second, participants
may be unable to provide precise information on the
experience of the first sexual intercourse they occurred
many years ago, resulting in information bias. Participants
tended to have underreported on some sensitive infor-
mation, such as sexual behaviour. In addition, partici-
pants tended to improve their levels of HIV/AIDS-related
knowledge after diagnosis of HIV infection, leading to
the overestimated accuracy rates of HIV/AIDS-related
knowledge questions. Third, we did not collect data on
the availability and accessibility of treatment and informa-
tion regarding issues of stigma and discrimination, which
could be conducted in the future survey.

CONCLUSIONS
This study reported a low level of HIV/AIDS-related knowl-
dge, a high level of exposure to risky sexual behaviours
and some valuable epidemiological characteristics
among HIV-positive male college students in Nanjing,
China. A considerable proportion of HIV-positive male
students did not know the serious status of the HIV/AIDS
epidemic among students who are MSM and had a low level of risk perceptions towards HIV infection. Comprehensive sex education should be carried out early and timely among Chinese students to improve the level of HIV/AIDS-related knowledge. Risk-awareness education is needed throughout the college stage to enhance the awareness of HIV/AIDS prevention and to reduce risky sexual behaviours among college students. Furthermore, the GSN apps should be fully used in programmes for HIV prevention given GSN apps have become the main tool for college students to seek sexual partners.

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Competing interests None declared.

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Patient consent for publication Not required.

Ethics approval This study was reviewed and approved by the Human Research Ethics Committee of the Zhongda hospital affiliated Southeast University, China (Approval ID: 2017ZDKYSB045). The objectives and the procedure of the study, and the potential risks and benefits of participating in the study were told to potential participants during the recruitment. Verbal or written consent procedures were obtained from participants and they had the right to discontinue the survey at any time.

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ORCID iDs Wei Li http://orcid.org/0000-0003-0769-5805
Zhengping Zhu http://orcid.org/0000-0003-3201-299X

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