

Service Acceptance of HIV Non-Occupational Post-Exposure Prophylaxis(nPEP) Among College Students: A Cross-Sectional Study in China

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Abstract

Background: College students are the key group we should pay more attention for acquired immune deficiency syndrome (AIDS) prevention and control in recent years in China, and few studies of HIV non-occupational post-exposure prophylaxis (nPEP) knowledge awareness and service acceptance have been conducted among them in China. This study conducted a cross-sectional survey to understand the service acceptance of nPEP and its influencing factors among college students in the three cities of China.

Methods: A questionnaire survey was conducted to collect information on socio-demographic, behavioral characteristic, HIV/AIDS knowledge, nPEP knowledge, acceptance of nPEP services among the college students in Beijing, Shenzhen, and Kunming of China from March to April of 2019. Each participant completed a computer-assisted or mobile phone-assisted self-interview with informed consent and completed an anonymous questionnaire on line. Multivariable logistic regression analyses identified predictors for service acceptance of nPEP.

Results A total of 4698 students were surveyed with the average age of 20 years old. 98.0% (4605/4698) of them were undergraduates, 21.8% (1022/4698) had sexual intercourse; 48.6% (2282/4698) had heard of nPEP, among which 4.95% (113/2282) received nPEP services. The rate of AIDS knowledge awareness was 85.6% (5495/4698) with the differences statistically significant between the three cities. The nPEP knowledge awareness rate was 16.5% (774/4698). There were differences in receiving nPEP services among students of different ages, genders, sexual behaviors, and knowledge of AIDS by univariate analysis. Multivariable analyses indicated that age group of 18 and under ($OR=2.551$, 95% $CI=1.153-5.646$), male ($OR=3.131$, 95% $CI=1.866-5.253$), homosexual behavior ($OR=4.661$, 95% $CI=2.658-8.172$), heterosexual behavior ($OR=1.676$, 95% $CI=1.040-2.947$), no awareness of AIDS ($OR=3.882$, 95% $CI=2.371-6.356$) and nPEP ($OR=4.788$, 95% $CI=2.50-9.169$) knowledge, were associated factors with the service acceptance of nPEP among the college students.

Conclusion The low acceptance of nPEP services was mainly affected by nPEP knowledge awareness among the college students and further publicity and education of nPEP knowledge are necessary, as well as dissemination of knowledge of HIV/AIDS prevention and treatment. More attention should be paid to the factors associated with acceptance of nPEP services.

Background

Acquired immune deficiency syndrome (AIDS) epidemic is at a low prevalence level in China. However, the distribution of the epidemic is unbalanced, and sexual transmission is the main route of transmission. The newly reported human immunodeficiency virus (HIV) /AIDS cases among young people aged 15-24 increased from 8,354 in 2008 to 16,307 in 2017, among which the proportion of students increased from 5.8% in 2008 to 18.9% in 2017, and the majority of the cases among college students were through male homosexual transmission, accounting for 57.9%[1].

According to the survey results of some parts of China, the prevalence of AIDS among college students is less than encouraging, especially in some cities where the number of colleges and universities concentrated[2]. Since 2012, the newly reported HIV infection among college students through male homosexual transmission, has posed a challenge to HIV/AIDS prevention and control[3]. By the end of June 2017, 1244 HIV cases have been reported among students in Beijing, including 722 college students, with 98.5% of males, and 86.7% infected with HIV through male homosexual transmission[4]. Among the newly detected HIV infections and patients each year, the number of HIV infections and patients among students showed an increasing trend year by year, accounting for 1.64% of the total cases reported from January to June in 2011, up from 0.96% in 2006 [5]. Based on the data above, we can conclude that young students have become a key group at the risk of HIV infection in China. The main characteristics of HIV infection among young students were sexual transmission, and the majority of newly reported HIV infected was male, mainly through homosexual transmission.

According to the previous investigation on "knowledge, faith and behavior" and behavioral characteristics, college students are sexually active, and a low rate of condom use, multiple sexual partners, casual sexual behavior, and a low awareness of sexual safety are the risk factors for HIV infection. The results of an internet survey among undergraduates of 34 cities in China showed 60.5% of them accepted the concept of sexual liberation, 67.1% had premarital sex, and 70.0% had unmarried cohabitation. The time of the first sexual act among college students is getting earlier. Although college students tend to be open-minded about the sexual attitudes and sexual behaviors, they lack appropriate sexual knowledge and the ability to prevent them from sexually transmitted diseases and AIDS. Another study showed that 22.3% of college students had two or more sexual partners in the past year, and only 15.3% of them insisted on condom use every sexual act, while 47.0% were not aware of the risk of HIV infection. In addition, with the popularity of social network software and applications, they are vulnerable to the risk factors out of the campus, prone to unsafe sex, synthetic drug abuse and other high-risk behaviors.

College students have a high knowledge awareness on AIDS, but poor protection awareness[6]. The result of a survey indicated that the condom use rate of the college students who had sexual experience is less than 25%[7], and students are sexually active, curious, prone to have unsafe sex and use of club drugs and other high-risk behaviors. With the increase of the proportion of sexual behaviors among college students and lack of self-protection awareness, college students are a key group for HIV/AIDS prevention and treatment in China[8].

Control of new HIV infection requires comprehensive use of sociological, behavioral, and biomedical measures. In addition of the strategies of early detection and treatment, we need more methods for AIDS prevention, including behavioral interventions, biomedical interventions, so as to provide more options for different needs of people. Non-occupational post-exposure prophylaxis (nPEP) refers to the provision of targeted preventive measures for the individuals at risk of being exposed to and infected with HIV through a series of services, so as to avoid their infection with HIV.

Since early 1990s, antiretroviral treatment has been prescribed for postexposure prophylaxis (PEP) following occupational exposure to HIV in many countries. This practice has since been extended to non-occupational situations, primarily for cases of sexual assault, isolated or episodic injecting drug use and consensual sexual exposure. Post-exposure prophylaxis (PEP) as a preventive treatment method will help people who exposed to a certain pathogen (such as HIV) for a certain period of time to prevent infection or disease caused by the pathogen[9].

In this study, the subjects are mainly HIV antibody negative, after risky behaviors that are not related to occupational exposure (including homosexual and heterosexual behavior without condom use; sharing needles with HIV-infected patients and other situations that may expose HIV), or in cases where the source of exposure is positive for HIV antibodies, after a comprehensive evaluation, determine whether to use antiretroviral drugs to prevent HIV infection.

USCDC and WHO/ILO respectively issued nPEP guidelines in 2005 and 2007, and recommended the use of antiviral drugs to prevent HIV infection in people at risk of sexual exposure or needle sharing. Recommended target populations for nPEP include those who had unprotected intrusive sexual behavior or needle-sharing with the source of exposure clearly HIV-infected or the state of infection unknown. The HIV antibody test of the exposed person was negative. The exposure time should not exceed 72 hours[9, 10]. Healthcare workers should evaluate and provide detailed nPEP compliance counseling to explain possible adverse reactions and treatment methods, emphasize the importance of follow-up, and make detailed case records and report to relevant institutions.

There is sufficient evidence to prove the effectiveness and safety of nPEP, and it has a significant effect on the reduction of new HIV infection[11]. However, the desired effect also depends on the cognition of service providers and target population on this strategy at the implementation level. The ability to effectively coordinate the institution of disease prevention and control, health care facilities, and community organizations to provide comprehensive and high-quality services

HIV/AIDS prevention and control agencies in many countries have also issued authoritative guidelines, pointing out and emphasizing the effectiveness of nPEP after high-risk behaviors, and recommending the use of antiretroviral drugs for nPEP to reduce new HIV infections[10, 12], which was based on previous preventive strategies such as publicity and education, condom promotion, and HIV counseling and testing. College students are the key population with concerns for AIDS prevention in recent years[7],and no relevant nPEP research has been carried out on this group in China. In this study, colleges students in Beijing, Kunming, and Shenzhen were recruited as the research participants to understand their behavioral characteristic, knowledge awareness of AIDS and nPEP, and acceptance of nPEP services as the potential nPEP clients.

Methods

Cross-sectional survey

As research target group, college students aged 18 years and older, of all grades were recruited in the universities in Beijing, Shenzhen, and Kunming. They participated in the survey voluntarily with informed consent.

This study was reviewed and approved by the Ethics Committee of the Center for STD and AIDS Prevention and Control, the Chinese Center for Disease Control and Prevention (Approval number: X190311556).

Data collection

We employed snowball sampling to recruit participants from colleges and universities with the help of volunteers of the student societies. Initial 'seed' participants were recommended by volunteers, who participated in the study and then invited other students to enroll in with the informed consent. The recruitment process continued from March to April 2019.

The colleges students completed an anonymous questionnaire on line with the application. The questionnaire consisted of three sections, with the first of socio-demographic information, behavioral characteristics, the second of awareness of AIDS and nPEP knowledge, and the third of acceptance of nPEP services. The questionnaires were collected by five hospitals of the three cities.

The interviewers were healthcare staff from AIDS clinics of five hospitals. They were uniformly trained on the survey operation manual, including the questionnaire content, precautions, and interview process, to guide the interviewees to fill in the questionnaire after scanning the Quick Response (QR) code by mobile phone and instructions assigned at the scene. If the interviewees were unable to fill in by using their mobile phone, they could finish a paper questionnaire on site, and then the interviewers transferred the information to the electronic questionnaire database.

Each online questionnaire was limited to one IP address for one interviewee. After the survey was completed, all questionnaires were checked for the completeness, logical review, and correction. We also checked the questionnaires with duplicate IP addresses, to avoid those who repeated filling out the questionnaires.

Variable definitions

AIDS knowledge awareness of college students in this study was followed by 'AIDS Monitoring and Evaluation Framework of China', which included eight questions [13], 1. Can a person tell that another person is infected with HIV based on his/her appearance? 2. Can a person be infected with HIV by a mosquito bite? 3. Can a person be infected with HIV by eating with a person with HIV? 4. Can a person be infected with HIV via HIV-infected blood transfusion? 5. Can a person be infected with HIV by sharing syringes with a person with HIV? 6. Can a baby born to an HIV-positive mother be infected with HIV? 7. Can the correct condom use reduce the spread of AIDS? 8. Can a person having sex with only one partner reduce the spread of AIDS? If any six or more questions of the eight questions were answered correctly, the interviewee was defined as having awareness of AIDS knowledge.

Awareness of nPEP knowledge defined by three questions, i.e. 1. What do you think the use of nPEP? 2. What situations do you think require application of nPEP? 3. Do you think condom should be used during PEP? If all the three questions are answered correctly by the interviewees, they are regarded to know basic facts of nPEP knowledge.

Acceptance of nPEP services included receiving nPEP counseling, HIV testing, the prescription of a 28-day course of ART drugs, and follow-up.

Statistical analysis

Descriptive statistics were used to describe participant's demographic characteristics. Univariate χ^2 test was used to compare the differences in the three cities, in acceptance of nPEP services among respondents with socio-demographic characteristics, AIDS prevention knowledge level, and behavioral characteristics. Multivariate logistic regression analysis was conducted to adjust odd ratios (*ORs*) for potential confounding. Only variables significant in univariate χ^2 analyses were included in the multivariate logistic regression models. A *P* value <0.05 (two-tailed) was statistically significant.

Results

Socio-demographic and behavioral characteristics

The number of participants from Beijing, Shenzhen, Kunming were 2780, 826, and 1092, respectively. A total of 4698 college students with mean (*SD*) age of 20.0 (1.5) years participated in the study. Table 1 displays the characteristics of the participants. Out of them, 71.1% (3340/4698) ranged from 19 to 21 years, 52.9% (2485/4698) were female, 98.0% (4605/4698) were undergraduates, and 79.4% (3730/4698) had no income monthly. Additionally, 21.7% (1022/4698) reported having sex experience, with 6.2% homosexual, 14.4 % heterosexual, and 1.1% bisexual. A significant difference was found among different socio-demographic characteristics and sexual behavior groups of the three cities (*p*<0.001).

Table 1. Socio-demographic and behavioral characteristics of college students in the three cities

Items	Number N (%)	Cities			χ^2	<i>p</i>
		Beijing N (%)	Shenzhen N (%)	Kunming N (%)		
Age (years)	4698	2780	826	1092	720.271	<0.001
18 and under	532 (11.3)	494 (17.8)	21 (2.5)	17 (1.5)		
19-	992 (21.1)	744 (26.8)	189 (22.9)	59 (5.4)		
20-	1343 (28.6)	671 (24.1)	276 (33.4)	396 (36.3)		
21-	1005 (21.4)	372 (13.4)	205 (24.8)	428 (39.2)		
22-24	826 (17.6)	499 (17.9)	135 (16.4)	192 (17.6)		
Gender	4698	2780	826	1092	217.211	<0.001
Male	2213 (47.1)	1512 (54.4)	210 (25.4)	490 (44.9)		
Female	2485 (52.9)	1268 (45.6)	616 (74.6)	602 (55.1)		
Education level	4698	2780	826	1092	23.977	<0.001
Undergraduate	4605 (98.0)	2702 (97.2)	820 (99.3)	1083 (99.2)		
Postgraduate	93 (2.0)	78 (2.8)	6 (0.7)	9 (0.8)		
Monthly income (RMB yuan)	4698	2780	826	1092	79.026	<0.001
No income	3730 (79.4)	2184 (78.6)	595 (72.0)	951 (87.1)		
0-1000	465 (9.9)	262 (9.4)	126 (15.3)	77 (7.0)		
>1000	503 (10.7)	334 (12.0)	105 (12.7)	64 (5.9)		
Sexual behavior	4698	2780	826	1092	62.305	<0.001
Homosexual	293 (6.2)	133(4.8)	47(5.7)	113(10.3)		
Heterosexual	676 (14.4)	446(16.0)	105(12.7)	125(11.4)		
Bisexual	53 (1.1)	23(0.9)	9(1.1)	21(1.9)		

Asexuality	3676 (78.3)	2178(78.3)	665(80.5)	833(76.3)
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Awareness of basic knowledge of AIDS prevention

Among college students surveyed in the three cities, 85.5% (5495/4698) answered any six or more of the eight questions correctly, and the awareness rates of college students in Beijing, Shenzhen and Kunming were 78.4%, 95.0% and 96.5%, respectively. The differences among the three cities were statistically significant ($p < 0.05$). The awareness rates of the four questions, " Can a person tell that another person is infected with HIV based on his/her appearance?", "Can a person receive HIV by a mosquito bite?". Can a person having sex with only one partner reduce the spread of AIDS?", and "Can a person be infected with HIV by eating with a person with HIV? ", were lower than 90% (See table 2).

Table 2. Knowledge of AIDS prevention among college students surveyed in the three cities

Questions	Number N (%)	Cities		
		Beijing (N=2780)	Shenzhen (N=826)	Kunming (N=1092)
		N (%)	N (%)	N (%)
Can a person tell that another person be infected with HIV based on his/her appearance?				
Yes	341 (7.3)	200 (7.2)	36 (4.4)	105 (9.6)
No	3733 (79.4)	2095 (75.4)	736 (89.1)	902 (82.6)
Unknown	624 (13.3)	485 (17.4)	54 (6.5)	85 (7.8)
Can a person be infected with HIV by a mosquito bite?				
Yes	1026 (21.8)	755 (27.2)	96 (11.6)	175 (16.0)
No	3282 (69.9)	1689 (60.7)	700 (84.8)	893 (81.8)
Unknown	390 (8.3)	336 (12.1)	30 (3.6)	24 (2.2)
Can a person be infected with HIV by eating with a person with HIV?				
Yes	366 (7.8)	303 (10.9)	28 (3.4)	35 (3.2)
No	4015 (85.5)	2200 (79.1)	775 (93.8)	1040 (95.2)
Unknown	317 (6.7)	277 (10.0)	23 (2.8)	17 (1.6)
Can a person be infected with HIV via an HIV-infected blood transfusion?				
Yes	4428 (94.3)	2566 (92.3)	786 (95.2)	1076 (98.6)
No	75 (1.6)	48 (1.7)	18 (2.1)	9 (0.8)
Unknown	195 (4.1)	166 (6.0)	22 (2.7)	7 (0.6)
Can a person be infected with HIV by sharing syringes with a person with HIV?				
Yes	4473 (95.2)	2586 (93.0)	810 (98.1)	1077 (98.6)
No	51 (1.1)	42 (1.5)	5 (0.6)	4 (0.4)
Unknown	174 (3.7)	152 (5.5)	11 (1.3)	11 (1.0)
Can a baby born to an HIV-positive mother be infected with HIV?				
Yes	4284 (91.2)	2424 (87.2)	787 (95.3)	1073 (98.3)
No	82 (1.7)	66 (2.4)	10 (1.2)	6 (0.5)
Unknown	332 (7.1)	290 (10.4)	29 (3.5)	13 (1.2)
Can the correct use of condom reduce the spread of AIDS?				

Yes	4235 (90.1)	2377 (85.5)	790 (95.6)	1068 (97.8)
No	117 (2.5)	95 (3.4)	13 (1.6)	9 (0.8)
Unknown	346 (7.4)	308 (11.1)	23 (2.8)	15 (1.4)
Can a person having sex with only one partner reduce the spread of AIDS?				
Yes	3642 (77.5)	1948 (70.1)	663 (80.3)	1031 (94.4)
No	448 (9.4)	320 (11.5)	96 (11.6)	32 (2.9)
Unknown	608 (12.9)	512 (18.4)	67 (8.1)	29 (2.7)

Awareness of nPEP knowledge

48.6% (2282/4698) of the students surveyed in the three cities had heard of nPEP. The overall nPEP knowledge awareness rate of students was 16.5% (774/4698), with 16.7% (463/2780) in Beijing, 11.4% (125/1092) in Kunming, 22.5% (186/826) in Shenzhen, and the proportion of students surveyed in the three cities on nPEP knowledge awareness were respectively and the difference was statistically significant ($P < 0.001$).

42.2% (963/2282) of the students who had heard of nPEP thought that the use of nPEP was to prevent HIV, and 57.2% (1305/2282) considered that nPEP should be taken within 72 hours after exposure. 39.3% (896/2282) thought that the price of nPEP varied according to the drug, and 97.2% (2219/2282) considered condom use during nPEP. See Table 3.

Table 3. Knowledge of nPEP among students surveyed in the three cities

Knowledge of nPEP		Cities		
		Beijing (N=1310)	Shenzhen (N=524)	Kunming (N=448)
N=2282		N (%)	N (%)	N (%)
N(%)		N (%)	N (%)	N (%)
What do you think is the use of nPEP?				
To treat HIV	498 (21.8)	280(21.4)	107 (20.4)	111 (24.8)
To prevent HIV	963 (42.2)	572(43.7)	231 (44.1)	160 (35.7)
To prevent STD	57(2.5)	41(3.1)	9 (1.7)	7 (1.6)
Not sure	764(33.5)	417 (31.8)	177 (33.8)	170 (37.9)
What situations do you think require nPEP?				
Being infected with HIV	116(5.1)	72 (5.5)	21 (4.0)	23 (5.1)
HIV-susceptible behavior occurred within the past 72 hours	1305 (57.2)	777 (59.3)	299 (57.1)	229 (51.2)
HIV-susceptible behavior occurred within a month ago	36(1.6)	23 (1.8)	8 (1.4)	5 (1.1)
Not sure	825 (36.1)	438 (33.4)	196 (37.5)	191 (42.6)
Do you think condom should be used during nPEP?				
Yes	2219 (97.2)	1260 (96.2)	518 (98.8)	441 (98.4)
No	63 (2.8)	50 (3.8)	6 (1.2)	7(1.6)
How much does nPEP cost?				
Free	471 (20.6)	263 (20.1)	140 (26.7)	68 (15.2)
Based on the type of drug used	896 (39.3)	520 (39.7)	191 (36.5)	185 (41.3)
Not sure	915(40.1)	527 (40.2)	193 (36.8)	195 (43.5)

Acceptance of nPEP services and its influencing factors

4.9% (113/2282) received nPEP services among those heard of nPEP. There was a statistically significant difference in acceptance of nPEP services among 2282 college students who heard of nPEP with different ages, gender, sexual behaviors, awareness of AIDS knowledge and nPEP knowledge ($P < 0.001$) (table 4).

Table 4. Acceptance of nPEP services among college students with different characteristics in the three cities

	Acceptance of nPEP services		
	Yes N (%)	No N (%)	<i>P</i>
Age(years)			<0.001
18 and under	23(14.8)	132(85.2)	
19-	28(5.6)	475(94.4)	
20-	28(4.1)	649(95.9)	
21-	20(4)	481(96)	
22-24	14(3.1)	432(96.9)	
Gender			<0.001
Male	91(8.8)	945(91.2)	
Female	22(1.8)	1224(98.2)	
Level of education			0.627
Bachelor	109(4.9)	2109(95.1)	
Postgraduate	4(6.3)	60(93.8)	
Monthly income (RMB yuan)			0.181
No income	83(4.8)	1640(95.2)	
0-1000	9(3.6)	243(96.4)	
>1000	21(6.8)	286(93.2)	
Sexual behavior			<0.001
Homosexual	29(12.2)	209(87.8)	
Heterosexual	25(6.8)	340(93.2)	
Bisexual	3(8.6)	32(91.4)	
Asexuality	56(3.4)	1588(96.6)	
Awareness of AIDS knowledge			<0.001
No	39(21.3)	144(78.7)	
Yes	74(3.5)	2025(96.5)	
Awareness of nPEPknowledge			<0.001
No	101(6.7)	1407(93.3)	
Yes	12(1.6)	762(98.4)	

A logistic regression analysis was conducted regarding the acceptance of nPEP services among college students who heard of nPEP to determine the factors most predictive of the acceptance. The findings could provide insight into the next steps for the education and promotion of nPEP among them. After the influence of confounding variables removed, the logistic regression analysis included the predictors such as socio-demographic information, awareness of AIDS knowledge, awareness of nPEP knowledge and sexual behavior. The results revealed that age, gender, sexual behavior, awareness of AIDS and nPEP knowledge predicted acceptance of nPEP services among college students ($P < 0.05$). The acceptance of nPEP services of male college students was three times ($OR = 3.131$, 95 % $CI = 1.866 - 5.253$) than that of females. Age was found to be a significant predictor for acceptance of nPEP services. Age group of 18 and under ($OR = 2.551$, 95 % $CI = 1.153 - 5.646$), and that of 19 years old age group ($OR = 1.928$, 95 % $CI = 0.949 - 3.917$) had higher acceptance of nPEP services compared to the age group between 22-24 years old.

Compared with those without sexual behavior, the acceptance of nPEP services was more than four times higher ($OR = 4.661$, 95 % $CI = 2.658 - 8.172$) among those with male homosexual behavior than those with asexual behavior, more than one time higher ($OR = 1.676$, 95 % $CI = 1.040 - 2.947$) among those with heterosexual behavior than those with asexual behavior.

College students without awareness of AIDS knowledge showed higher acceptance of nPEP services compared to those with the awareness ($OR = 3.882$, 95 % $CI = 2.371 - 6.356$). Those without awareness of nPEP knowledge predicted higher acceptance of nPEP services compared to those with the awareness ($OR = 4.788$, 95 % $CI = 2.50 - 9.169$) Table 5.

Table 5. Multivariate logistic analysis of acceptance of nPEP services among college students who heard of nPEP with different characteristics in the three cities

Influence factor	B	S.E.	Wald χ^2	P	OR(95% CI)
Age					
22-24					1
18 and under	0.937	0.405	5.339	0.021	2.551(1.153-5.646)
19-	0.657	0.362	3.298	0.069	1.928(0.949-3.917)
20-	0.286	0.354	0.653	0.419	1.331(0.665-2.663)
21-	0.322	0.373	0.744	0.388	1.379(0.664-2.865)
Gender					
female					1
male	1.141	0.264	18.687	0.000	3.131(1.866-5.253)
Sexual behavior					
Asexuality					1
Homosexual	1.539	0.286	28.864	0.000	4.661(2.658-8.172)
Heterosexual	0.56	0.266	4.441	0.035	1.676(1.040-2.947)
Bisexual	0.381	0.671	0.323	0.570	1.257(0.393-5.452)
Awareness of AIDS knowledge					
Yes					1
No	1.356	0.252	29.075	0.000	3.882(2.371-6.356)
Awareness of nPEP knowledge					
Yes					1
No	1.566	0.331	22.319	0.000	4.788(2.50-9.169)

Discussion

To response HIV infections among the college students, the National Health Commission of China keeps continuously strengthening the publicity and health education to reduce HIV infection risks of the students, and improve their self-protection capabilities[8, 14]. Due to the factors such as acceptance of a natural opening to sex, and being in the sexually active period, the implementation of nPEP among college students is one of the measures and strategies to prevent HIV infection after high-risk behaviors[15, 16]. It is necessary for the college students to understand and be aware of the nPEP knowledge and the access to nPEP services in order to timely receive nPEP after their exposure to high-risk sexual behaviors and reduce the risks of HIV infection.

21.7% of the surveyed students had sexual behavior in this study and among them 28.7% was homosexual, 66.1% heterosexual, and 5.2% bisexual. The rate of sexual behavior was much less than the rate (50%) of the 15-24 teenagers who had sex with temporary partners [17], but more than the rate of self-reported sexual behavior among college students in a cross sectional study nationwide during 2010-2015, which was from 8.3% to 10% [18], and the result of the study in Zhejiang province of China (6.5%) [19].

This study found that the average awareness rate of AIDS knowledge among the college students in the three cities (85.6%) was higher than that of the students in Tanjin (75.8%) [20] and Harbin (72.7%) [21], which was similar to the results of the students in the survey of surveillance sentinel in Haikou (81.1% -88.5%) in recent years [22]. In the three cities, the awareness rate of the college students in Beijing was significantly lower than that in the other two cities. The reason may be related to the sample size, in which the students in Beijing was larger and younger with less relevant AIDS knowledge, than those of other two cities. So the rate of 85.6% is lower than the rate required by the national health authority on the awareness rate of AIDS prevention knowledge among college students 95% [23]. It suggests we need to further strengthen the AIDS knowledge education especially for the freshmen when they were enrolled in the colleges [24].

The rates of once hearing of nPEP services, awareness of nPEP knowledge, and acceptance of nPEP services among the college students were 48.6%, 16.5%, and 2.4% respectively. There was a trend of gradual downward among these three indexes. This trend showed the logical relation of KABP (knowledge, attitude, belief, practice) pattern of behavior change. The results also showed 48.6% of the college students in this survey heard of nPEP, which was higher than that of MSM with 24.2% in other study in Guangxi of China [25]. 42.2% of students who heard of nPEP knew the role of nPEP as preventing HIV correctly. 57.2% of them thought nPEP should be initiated as soon as possible, within no later than 72 hours after the potential exposure. This finding reflects the awareness of comprehensive knowledge of nPEP related the role and the timing of nPEP, which were the basic criteria of clinical management of nPEP, was weak and poor among college students.

During nPEP medications, it is necessary to maintain HIV preventive approaches such as using condom. 97.2% of students who heard of nPEP knew using a condom while taking nPEP. It will help college students to avoid behavioral disinhibition occurs during nPEP medications. The behavioral disinhibition of nPEP receivers will decrease condom use or increase other HIV infection risk behaviors, because they think they are protected from HIV infection by nPEP.

Although the correct awareness rates of any single question about nPEP was high (42.2%, 57.2%, 97.2%), the level of comprehensive rate (16.5%) was still low. This finding might related to health education for AIDS and nPEP knowledge in college campus was not enough or not effective, and suggests that comprehensive PEP knowledge publicity and education should be given to college students to help them to recognize the risk of HIV-related behaviors, and acquire the knowledge and skills of nPEP, while health education of the knowledge of AIDS prevention and control combined with publicity campaigns delivered by the colleges, student club or union, etc.

According to the survey, the rate of awareness of nPEP knowledge among college students who know the knowledge of AIDS was higher than that of those who do not know the knowledge of AIDS. The reason may be the correlation of knowledge of AIDS and nPEP knowledge, and awareness of knowledge of AIDS will promote acquisition of knowledge of AIDS. The result suggests that the content of health education in college should adapt to the new situation which the number of newly reported HIV/AIDS cases among college students has been increasing year by year, and the transmission route is mainly by male homosexual transmission, the prevention and control facing with more challenges in college.

To remove the influence of confounding variables, the logistic regression analysis included predictors such as social demographic information, knowledge of AIDS and nPEP, and sexual behavior characteristic. We found the received nPEP services among college students age 18 and below and 19-year-old age group were higher compared with the students with age group of 22-24 years old. The reason for this result likely to be that college students age 18 and below and 19-year-old age group were freshman and sophomore of college; when students enter college, they are relieved from highly intensive study pressure and entrance tests in high school, escaping their parents' supervision and school's management[26]. And they had less academic burden and more social time when college beginning. Students have ready access to information via the Internet and can connect to social networks, e.g., the gay community, casual sex partner[27]. Therefore, it is important to develop health education lessons and materials targeting the freshman and sophomore of college.

Through analysis, it was found that the proportion of male college students was higher in nPEP medication than female students. It is suggested that male students may have high-risk behaviors or factors that lead to high-risk behaviors when they are newly enrolled. Students have certain demands for nPEP medication. The part of students at this stage should be the critical point and target of AIDS prevention and control in colleges.

The proportion of college student's male homosexual and heterosexual behavior received nPEP services was higher than asexuality student group. The high proportion of receiving nPEP services indirectly reflects the high incidence of high-risk behaviors among this group. It is suggested that the group of men who have sex with men is the main high-risk group among college students. After realizing the risk of HIV exposure or high-risk sexual behavior, they have a strong sense of seeking counseling and assistance, and a willingness to further accept nPEP services. It also reminded that men who have sex with men among college students are the key people in the comprehensive intervention of AIDS prevention and control in colleges and universities[28,29], and the target population of nPEP knowledge promotion. With the development of economy and the frequent international cultural exchanges in recent 20 years, the Chinese have become more tolerant toward various sexual practices, sexual freedom, and openness, like homosexuality, casual sex and pre-marital sex, especially among youths. The results of previous studies showed that the phenomenon of high level of knowledge related to AIDS[30,31], but more sexual partners and low condom utilization rate also exists widely among MSM college students. It was necessary and urgency of carrying out effective knowledge publicity of AIDS prevention and control, and nPEP knowledge in colleges and providing the classes of health education. While promoting nPEP knowledge,

colleges and universities should still emphasize the importance of healthy sex, safe sex and condom use, so as to prevent over-reliance on nPEP and "disinhibition" of high-risk behaviors.

MSM college students are characterized by the high-risk HIV-related sexual behaviors, such as young age of first intercourse, multi-sex partners, low rate of condom use, group sex, commercial behavior and drug abuse. Particularly, they usually had high rate of AIDS knowledge, but low rate of safe sexual behavior like condom use, and more sexual partners. AIDS prevention and treatment for this group needs to be paid more attention, and effective measures are urgently needed to intervene high-risk sexual behaviors.

The result of the study showed the awareness of AIDS and nPEP knowledge among the college students were factors for acceptance of nPEP services. The group without the knowledge had the higher rate of the acceptance of nPEP services than that with AIDS and nPEP knowledge because the group without AIDS and nPEP knowledge would have more high-risk behavior, which was more likely to lead them to access to the nPEP services. It is recommended that public education be promoted to increase nPEP knowledge and services for the college students, to let them know what is the nPEP, what is the time for nPEP, and how to assess the risk of exposure to the infection, HIV counseling and testing, management, and follow-up.

There were some limitations in this study. First, the definition of nPEP knowledge awareness only covers three questions, related to the use of nPEP by the potential users, timing of nPEP and condom use during nPEP. It is not related to counseling and testing, treatment, and follow-up. The questions need to be developed further and standardized in the future. Second, the distribution of the college students in the study were unevenly in grades, with fewer freshmen and seniors about to graduate, and the group may have relatively high-risk behavior. Third, the nPEP services should include counseling, testing and antiretroviral drug treatment (ART). This might be because parts of the college students may only access to counseling and testing services without taking nPEP for 28 days, and they had not experienced in the whole process of nPEP. This may be because the surveys were conducted online and some participants just received counseling without taking nPEP, so the number of the students receiving nPEP services may be overestimated. Forth, because the snowball sampling was used instead of common statistical sampling methods in this study, the sample was not fully representative of college students.

We will further refine high-risk sexual behavior factors, such as condom use, number of sex partners, and explore the impact of behavioral factors other than sexual behavior factors on nPEP knowledge and application among college students.

Conclusion

The college students have a low rate of nPEP knowledge, due to lack of health education on knowledge for AIDS prevention and control in the college, which also leads to the low acceptance of nPEP services. The nPEP knowledge should be combined with the promotion of the knowledge of AIDS prevention and health education in the college, so that the students may know there are "medicine for regret" after high-risk behaviors, know how to access to the counseling and nPEP services to reduce the risk of HIV

infection. It is suggested that colleges and health departments should cooperate closely to promote health education and reproductive health for AIDS prevention and control, to advocate health values and safe sexual behavior, and improve their self-protection awareness among college students.

Declarations

Ethics approval and consent to participate

The investigation was carried out in accordance with the latest version of the Declaration of Helsinki. This study was reviewed and approved by the Ethics Committee of the Center for STD and AIDS Prevention and Control, the Chinese Center for Disease Control and Prevention, and written informed consent was obtained from each participant.

Consent for publication

Not applicable.

Availability of data and materials

Available upon request to the corresponding author liuan75@163.com

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The original study protocol was written by A.L, G.Z, and T.T.L,Z.G contributed substantially to the design of the study protocol. X.W, J.Z.Y and A.X.L were responsible for execution of the study and recruitment of the participants. G.Z and D.S performed the statistical analysis. A.L, G.Z, and T.T.L interpreted the data. T.T.L wrote the manuscript; A.L, G.Z, and D.S revised the manuscript. All authors had full access to the data in the study, and read, revised and approved the final manuscript.

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References

1. *HIV prevalence situation in China in 2018*. [cited 2020 09-15]; Available from: https://www.sohu.com/a/283252730_99999398.
2. Li G, Jiang Y, Zhang L. HIV upsurge in China's students. *Science* 2019;364:711
3. McLaughlin K. HIV infections are spiking among young gay Chinese. *Science* 2017; 355(6332): 1359.
4. Chen H.J., Jiao K.W. Institutionalization and improvement of AIDS prevention and control in colleges and universities in Beijing [J]. *Chin J AIDS STD*, 2019.25(2):p. 209-212
5. World Health Organization. Estimates of the AIDS epidemic in China in 2011 [J]. *Chin J AIDS STD*, 2012, 18(1):1-5.
6. Hightow, L.B., et al., *The unexpected movement of the HIV epidemic in the Southeastern United States: transmission among college students*. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 2005. **38**(5): p. 531-537.
7. Shuping, H., et al., *Analysis of HIV / AIDS surveillance among young students in Haikou City from 2004 to 2008*. *Chinese Journal of Preventive Medicine*, 2009(02): p. 173-174.
8. *The Ministry of Education and National Health Commission jointly promot AIDS prevention education in schools in the new era*. [cited 2020 09-15]; Available from: http://www.gov.cn/xinwen/2019-10/14/content_5439614.htm.
9. WHO and ILO, *Joint WHO/ILO guidelines on post-exposure prophylaxis(PEP) to prevent HIV infection*
10. Centers for Disease Control and Prevention, U.S. *Updated Guidelines for Antiretroviral Postexposure Prophylaxis After Sexual, Injection Drug Use, or Other Nonoccupational Exposure to HIV-United States, 2016*. [cited 2020 09-15]; Available from: <https://www.cdc.gov/hiv/pdf/programresources/cdc-hiv-npep-guidelines.pdf>.
11. Koyama A, M.L., Bullock A., *Updates on HIV nonoccupational postexposure prophylaxis* *Curr Opin Pediatr*, 2019. **Aug:31**((4)): p. 454.
12. Draughon JE and S. DJ, *Nonoccupational postexposure prophylaxis for human immunodeficiency virus in Sub-Saharan Africa: a systematic review*. *J Forensic Nurs*, 2011. **7**(2): p. 89-96.
13. Dai W , Luo Z , Xu R , et al. Prevalence of HIV and syphilis co-infection and associated factors among non-commercial men who have sex with men attending a sexually transmitted disease clinic in Shenzhen, China[J]. *Bmc Infectious Diseases*, 2017, 17(1):86.
14. Agency, X.N. *The general office of the State Council issued the 13th five year plan of action to stop AIDS in China*. [cited 2020 09-15]; Available from: http://www.gov.cn/xinwen/2017-02/05/content_5165615.htm.

15. Zunyou, W., *Situation and strategy of AIDS prevention and control in schools in China*. Chin J Sch Health, 2015. **36**(11): p. 1604-1605.
16. Jianxin, Z., *Strategies for prevention and control of AIDS among young students*. Chin J Sch Health, 2016. **37**(11): p. 1601-1603.
17. Cai R, et al., *Trends in high-risk sexual behaviors among general population groups in China: a systematic review*. PLoS One, 2013. **(11);8**.
18. Ge, L., et al., *Cross-sectional study on AIDS/HIV related sexual behavior among students from 2010-2015*. Chin J Sch Health, 2015. **36**(11): p. 1611-1613+1617.
19. Jun, J., et al., *HIV testing willingness and influencing factors among 535 college students who have sex in Zhejiang Province*. Chinese Journal of Epidemiology, 2016. **37**(10): p. 1356-1360.
20. Yi, L., et al., *Investigation on sexual education, attitude and knowledge of AIDS among college students in Tianjin*. Chin J Prev Contr Chron Dis, 2019. **27**(03): p. 201-203.
21. Xue, G., et al., *Analysis of sentinel surveillance of AIDS among young students in Harbin in 2016*. International Journal of Immunology, 2018. **41**(02): p. 166-170.
22. Shuling, Y. and S. Xiuhong, *AIDS sentinel surveillance among young students in Haikou, 2011-2014*. Modern Preventive Medicine, 2018. **45**(19): p. 3609-3612.
23. Ministries, N.H.C.a.o. *Implementation Plan to Stop the Spread of AIDS (2019- 2022)* [cited 2020 09-15]; Available from: http://ncaids.chinacdc.cn/xxgx/zcwj/201910/t20191012_206158.htm.
24. Li W , Chu J , Zhu Z , et al. Epidemiological characteristics of HIV infection among college students in Nanjing, China: a cross-sectional survey[J]. BMJ Open, 2020, 10(5):e035889.
25. Zi, Z., et al., *Demand for non-occupational post-exposure prophylaxis and its influencing factors among 344 men who have sex with men in Guangxi*. Chinese Journal of AIDS & STD, 2017. **23**(07): p. 620-624.
26. Xu H, Xie J, Xiao Z, et al. Sexual attitudes, sexual behaviors, and use of HIV prevention services among male undergraduate students in Hunan, China: a cross- sectional survey. BMC Public Health 2019;19:250
27. Lan Zhang, X.D., Rongrong Lu,Liangui Feng,Xuefeng Li,Yan Xiao ,Yuhua Ruan ,Sten H. Vermund,Yiming Shao,Han-Zhu Qian, *Predictors of HIV and syphilis among men who have sex with men in a Chinese metropolitan city: comparison of risks among students and non-students*. PLoS One, 2012(7(5)).
28. Hehua Xu JX, Zhizi Xiao. Sexual attitudes, sexual behaviors, and use of HIV prevention services among male undergraduate students in Hunan, China: a cross-sectional survey. BMC Public Health 2019; 190: 250.
29. Yang Z, Huang Z, Dong Z, Zhang S, Han J, Jin M. Prevalence of high-risky behaviors in transmission of HIV among high school and college student MSM in China: a meta-analysis. BMC Public Health 2015; 15: 1272

30. Ma W, Wu G, Zheng H, et al. Prevalence and risk factors of HIV and syphilis, and knowledge and risk behaviors related to HIV/AIDS among men who have sex with men in Chongqing, China. *J Biomed Res* 2016;30:101–11
31. Samkange- Zeeb FN, Spallek L, Zeeb H. Awareness and knowledge of sexually transmitted diseases (STDs) among school- going adolescents in Europe: a systematic review of published literature. *BMC Public Health* 2011;11:727.