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Awareness, attendance, and attitudes toward cervical cancer screening among HIV-positive Chinese women in Yunnan province: a cross-sectional study

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Abstract

Background Cervical cancer is a major health threat in the female population. Human immunodeficiency virus (HIV)-positive women encounter a higher risk of cervical cancer. It is significant to promote cervical cancer screening attendance among HIV-positive women. Little is known about the awareness, attendance, and attitudes toward cervical cancer screening, as well as the associated factors, among Chinese HIV-positive women.

Methods A cross-sectional study was conducted among 411 HIV-positive women attending a large ART clinic in Yunnan, an HIV-endemic province in China. Participants were recruited using the convenient sampling method from January 2019 to August 2020. An interviewer-administered semi-structured questionnaire was utilized to collect information on socio-demographic and behavioral characteristics, clinical characteristics related to HIV infection, awareness, attendance, and attitudes toward cervical cancer screening. Binary logistic regression analyses were used to determine factors associated with awareness, attendance, and attitude toward cervical cancer screening.

Results Some 69.8% (287) of the participants were aware of cervical cancer screening, but only 27.7% (114) had attended screening within 3 years. After receiving a brief health education, 72.3% (297) of the participants exhibited a positive attitude toward cervical cancer screening. Participants with a higher education background and longer duration of antiretroviral therapy were more likely to be aware of cervical cancer screening and have up-to-date screening. The up-to-date screening attendance was also influenced by age, smoking status, and health insurance. Single participants were less likely to show a positive attitude toward cervical cancer screening compared married or cohabiting counterparts. The main facilitators to attending cervical cancer screening were health promotion activity and well-organized programs, while the main barriers were high costs of the service and inadequate awareness.

Conclusions Although most HIV-positive women attending a large ART clinic in Yunnan were aware of cervical cancer screening, the up-to-date attendance was low. It is crucial to conduct health education and promotion through efficient channels to improve awareness and attendance. The discrepancy between awareness and attendance also emphasized the importance of adopting appropriate screening strategies and powerful health policies that can foster the attendance of cervical cancer screening among HIV-positive women. Efforts should be devoted

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to constructing a comprehensive healthcare system with high accessibility in China for cervical cancer prevention and management for HIV-positive women.

Keywords Cervical cancer screening, Women living with HIV, Awareness, Attendance, Attitude

Background

Cervical cancer is ranked 4th in terms of cancer incidence and death among females worldwide in recent years [1, 2]. High-risk human papillomavirus (hr-HPV) infection is a fundamental cause of most cervical cancer cases [3], and human immunodeficiency virus (HIV) infection may facilitate its oncogenesis via immune suppression [4]. HIV-positive women have a disproportionally higher risk of cervical hr-HPV infection and persistence, development of precancerous lesions [5], cancer incidence [6], and mortality [7] compared to HIV-negative women. In addition, levels of viral load (VL) and cluster of differentiation 4 (CD4) + T-cell count are associated with varying risks of cervical hr-HPV acquisition and lesion progression [5]. Globally, 4.6% of the cervical cancer cases that emerged in 2020 were attributed to HIV infection, highlighting a double burden suffered by the female population [8]. China has been imperiled by the severe threat of cervical cancer for decades [9, 10] and accounts for approximately one-fifth of the total global burden [1, 2]. Besides, China also accommodated more than 1.05 million residents living with HIV until the end of 2020 [11]. The prevalence of cervical cancer among HIV-positive Chinese women was estimated to be 1.9%, 4.8 times higher than that of HIV-negative women [12]. Hence, HIV-positive women are a vulnerable population that should be prioritized in cervical cancer control.

It is crucial to adopt a comprehensive prevention strategy to alleviate the burden of cervical cancer among HIV-positive women. However, the role of prophylactic HPV vaccination as primary prevention might be constrained in mainland China, as evidenced by the low vaccination rate among females aged 9–45 years (10.15% for the first dose and 6.21% for the third dose in 2022) [13] and the high prevalence of hr-HPV and precancers among HIV-positive women [12, 14]. As a consequence, cervical cancer screening is currently a pivotal method to mitigate the risk, especially for HIV-positive women infected with hr-HPV or having precancerous lesions already. The World Health Organization (WHO) advocates a 3- to 5-yearly screen-triage-treat strategy initiated at the age of 25 years for HIV-positive women [15]. Further, model studies have undergirded the indispensable role of the screening for HIV-positive women in the framework of global cervical cancer elimination [16–18]. China initiated the free-of-charge national program for cervical cancer screening for rural females aged 35–64 years in 2009. Nevertheless, only a study conducted in Hunan province with a small sample size demonstrated that the proportion of HIV-positive Chinese women ever attending cervical cancer screening was approximately one-third, which might even overestimate the screening rate due to self-reported information and the HIV/acquired immunodeficiency syndrome (AIDS) clinic setting [19]. This implicates a huge gap existing toward the 70% goal proposed by WHO. Hence, efforts should be made to promote attendance of cervical cancer screening among HIV-positive women in China to reduce the morbidity and mortality of cervical cancer.

It is important to characterize the HIV-positive population to initiate their attendance of cervical cancer screening. Precedent studies identified awareness and positive attitude toward the screening as promoting factors of attendance [20, 21], but few studies have revealed the patterns of awareness and attitude among HIV-positive Chinese women. Associated factors of the screening attendance among HIV-positive Chinese women were implied by the sole study conducted in Hunan province to be the knowledge and emergence of non-gynecological symptoms [19]. Nonetheless, clinical characteristics related to HIV infection were rarely considered. In this study, we aimed to investigate the awareness, attendance, and attitudes toward cervical cancer screening and their associated factors among HIV-positive Chinese women in an HIV-endemic province. The findings of this study might help pave the way for health promotion and the construction of policies on cervical cancer screening for HIV-positive women in China and other HIV-endemic regions.

Methods

Study design and population

This cross-sectional survey was a subproject of a study on the prevalence of HPV infection and cervical lesions among HIV-positive Chinese women, conducted from January 2019 to August 2020 at the antiretroviral therapy (ART) clinic of the Third People's Hospital of Kunming (TPHK), Yunnan province, China. Located in southwestern China near Asia's "Golden Triangle," Yunnan had the first outbreak of HIV in China [22] and is still one of the provinces plagued with a heavy burden of HIV/AIDS [23]. The TPHK is one of the largest facilities for the healthcare of infectious diseases in southwestern China, and its ART clinic is the most visited HIV/AIDS clinic

among patients infected with HIV in Yunnan. Women attending the ART clinic who met the following inclusion criteria were considered eligible: (i) HIV-1 seropositive and with ongoing ART, (ii) aged 18 years or older, (iii) had initiated sexual activity, (iv) had an intact cervix, (v) not currently pregnant, and (vi) able to attend the survey and answer the questions independently.

Sample size determination, sampling procedure, and power estimation

Since this study was a subproject, the sample size was determined by the primary outcome of the main study. The sample size was calculated using PASS software version 12.0 utilizing the "Confidence Intervals for One Proportion" method, assuming a 95% confidence level and allowing a 5% margin of error. A previous study on HIV-positive Chinese women demonstrated that the rate of hr-HPV infection was approximately 26% [24], and thus the sample size was calculated to be 314 with the assumption of proportion equaling 0.26. The final sample size was determined to be 419 in anticipation of a 25% non-response rate. Eligible participants were recruited using the convenient sampling method from the ART clinic of TPHK in Yunnan, China, by a team of research assistants possessing at least a bachelor's degree in public health or clinical medicine from January 2019 to August 2020 when the desired sample size was attained.

Of 419 HIV-positive women approached, 411 had valid responses in this subproject. We calculated the power utilizing the "Tests for One Proportion" method, assuming a 95% confidence level and specifying a sample size of 411. For the effect size, the null proportion was assumed to be 0.257, deriving from a nationwide study that found the cervical cancer screening rate among common Chinese women was 25.7% [25]. The alternative proportion was assumed to be 0.366, according to Lin et al. [19] that cervical cancer screening rate among HIV-positive Chinese women was 36.6%. The power was estimated to be 0.998, suggesting the sample size was enough to detect the difference regarding cervical cancer screening attendance between common females and HIV-positive women with a desired power.

Instrument and data collection

After providing written informed consent, participants were interviewed face-to-face by a trained research assistant using a semi-structured questionnaire in Chinese specifically designed for the study (see the English version of the questionnaire in Additional file 1, Questionnaire form). The questionnaire was pretested for comprehensibility, acceptability, and language appropriateness among 20 HIV-positive women meeting the inclusion criteria in a branch of the TPHK who were not included in the final study. The questionnaire was composed of 5 sections: (i) socio-demographic and behavioral characteristics, (ii) clinical characteristics related to HIV infection, (iii) awareness of cervical cancer screening and the source of information, (iv) previous cervical cancer screening attendance, and (v) attitudes toward cervical cancer screening and perceived facilitators and barriers. The interested outcomes "awareness of cervical cancer screening," "up-to-date cervical cancer screening attendance," and "positive attitude toward cervical cancer screening" were the dependent variables. Participants who had heard of cervical cancer screening were identified as being aware of cervical cancer screening. Participants having a record of cervical cancer screening within 3 years were classified as having up-to-date attendance. Participants willing to attend regular cervical cancer screening, attend further examinations if recalled, and receive therapy if necessary were identified as showing a positive attitude toward cervical cancer screening, whereas those expressing unwillingness to attend any of the three procedures were categorized as not showing a positive attitude. Independent variables included socio-demographic and behavioral characteristics and clinical characteristics related to HIV infection. These characteristics were categorized into mutually exclusive groups, as shown in Table 1.

Some of the characteristics were extracted from the clinic information system, including age, marital status, health insurance, parity, and those related to HIV infection, as well as previous cervical cancer screening attendance. Other characteristics were obtained from self-reported information. A brief health education on cervical cancer and its screening was offered to all participants before the interview on attitudes. The content mainly included the basic physiology of the reproductive system, risk factors for cervical cancer, development of cervical lesions, and prevention strategies for cervical cancer. Participants with a positive attitude toward cervical cancer screening were required to state their perceived facilitators to the screening. On the contrary, participants who did not show a positive attitude listed their perceived barriers. Key factors were extracted from the statements and categorized into several themes. Participants with low literacy were interviewed by a trained health assistant who took command of the local language. Data collection was under the supervision of a researcher to ensure quality. All information obtained was coded and input by two trained health workers independently and then checked for discrepancies and mistakes by a third health worker.

Table 1 Characteristics of the participants

Characteristics (*N* = 411)	*N* (%) or median (IQR)
Socio-demographic and behavioral characteristics	
Age (years)	41 (35–48)
≤ 30	39 (9.5)
31–40	161 (39.2)
41–50	133 (32.4)
> 51	78 (19.0)
Marital status	
Single	16 (3.9)
Divorced/widowed	152 (37.0)
Married/cohabiting	243 (59.1)
Occupational status	
Employed	207 (50.4)
Unemployed	204 (49.6)
Education[a]	
≤ Primary	141 (34.3)
Secondary	227 (55.2)
Tertiary	43 (10.5)
Annual household income (CNY)[b]	
< 30,000	275 (66.9)
30,000–59,999	87 (21.2)
≥ 60,000	49 (11.9)
Health insurance	
UEBMI	44 (10.7)
URBMI	91 (22.1)
NRCMS	223 (54.3)
Not covered by national schemes	53 (12.9)
Current smoker	
Yes	40 (9.7)
No	371 (90.3)
Current use of contraception	
Yes	345 (83.9)
No	66 (16.1)
Parity	
0	64 (15.6)
1	197 (47.9)
≥ 2	150 (36.5)
Clinical characteristics related to HIV infection	
Duration of ART (years)	
< 2	81 (19.7%)
≥ 2	258 (62.8%)
No record	72 (17.5%)
Most recent CD4 count (cells/μL)	
< 500	151 (36.7%)
≥ 500	215 (52.3%)
No record	45 (10.9%)
Most recent HIV VL (copies/mL)	
< 50	346 (84.2%)
≥ 50	15 (3.6%)
No record	50 (12.2%)

ART antiretroviral therapy, *CD4* cluster of differentiation 4, *CNY* Chinese Yuan, *HIV* human immunodeficiency virus, *IQR* interquartile range, *NRCMS* new rural cooperative medical scheme, *UEBMI* urban employee basic medical insurance, *URBMI* urban resident basic medical insurance, *VL* viral load

[a] ≤ Primary: indicates receiving no formal education or completing primary school;

Secondary: indicates completing junior high school, senior high school, or secondary vocational school;

Tertiary: indicates completing undergraduate education, postgraduate education, or tertiary vocational school

[b] During 2019–2020, 1 CNY was equal to 0.145 USD

Data analysis

Data were cleaned and analyzed using Statistical Product and Service Solutions (SPSS) Statistics software version 26.0. Descriptive statistics was employed to report participants' characteristics. Frequency with percentage was used to describe qualitative variables and median with interquartile range (IQR) was used to describe quantitative variables. Unconditional binary logistic regressions were performed to identify factors associated with awareness of cervical cancer screening, up-to-date cervical cancer screening attendance, and positive attitude toward cervical cancer screening. Variables with a p-value of < 0.1 at the univariate level were included in the multivariate logistic regression model to control potential confounders. A crude odds ratio (cOR) and adjusted OR (aOR) with a 95% confidence interval (CI) were calculated to assess the strength of associations, with a p-value of < 0.05 considered statistically significant. The multivariate models were checked for goodness of fit by the Hosmer–Lemeshow test and were not significant.

Results

Characteristics of the participants

The age ranged from 20 to 68 with a median (IQR) of 41 (35–48) years. More than half were married or cohabiting (59.1%) and employed (50.4%). 10.5% had completed tertiary education. Approximately two-thirds (66.9%) reported a household income of less than 30,000 CNY annually. A minority (12.9%) were not covered by any of the national health schemes. Most (90.3%) were not smoking currently. A total of 16.1% did not take any contraceptive measures and 15.6% had not given birth yet. Less than one-fifth (19.7%) received ART for less than 2 years. A total of 52.3% had a CD4 count not less than 500 cells/μL and 84.2% had an HIV VL of less than 50 copies/mL (Table 1).

Awareness of cervical cancer screening

Two hundred and eighty-seven (69.8%) of the women in our study were aware of cervical cancer screening. In the multivariate analysis, women with higher education background (compared with ≤ primary education, aOR = 2.587 [95% CI: 1.545–4.333] for secondary education and aOR = 5.162 [95% CI: 1.339–19.906] for tertiary education) and longer duration of ART (compared with < 2 years, aOR = 1.906 [95% CI: 1.005–3.612] for ≥ 2 years) were more likely to be aware of cervical cancer screening (Table 2). Two-thirds (66.9%) of the women aware of the screening received the information from health professionals. Non-print media was listed as an information source by less than one-fifth (19.2%) (Fig. 1).

Table 2 Factors associated with awareness of cervical cancer screening

Variables	Awareness *N* (%)	Univariate analysis		Multivariate analysis	
		cOR (95% CI)	*p* value	aOR (95% CI)	*p* value
Socio-demographic and behavioral variables					
Age (years)					
≤ 30	32 (82.1)	4.343 (1.713–11.013)	0.002	2.365 (0.758–7.374)	0.138
31–40	121 (75.2)	2.874 (1.625–5.082)	< 0.001	1.989 (0.967–4.092)	0.062
41–50	94 (70.7)	2.290 (1.282–4.090)	0.005	1.536 (0.766–3.080)	0.227
> 50	40 (51.3)	1.000		1.000	
Marital status					
Unmarried[a]	125 (74.4)	1.453 (0.939–2.251)	0.094	1.522 (0.886–2.614)	0.128
Married/cohabiting	162 (66.7)	1.000		1.000	
Occupational status					
Employed	138 (66.7)	0.738 (0.483–1.127)	0.160	——	
Unemployed	149 (73.0)	1.000			
Education					
≤ Primary	71 (50.4)	1.000		1.000	
Secondary	176 (77.5)	3.402 (2.161–5.357)	< 0.001	2.587 (1.545–4.333)	< 0.001
Tertiary	40 (93.0)	13.146 (3.886–44.474)	< 0.001	5.162 (1.339–19.906)	0.017
Annual household income (CNY)					
< 30,000	176 (64.0)	1.000		1.000	
30,000–59,999	65 (74.7)	1.662 (0.966–2.859)	0.066	1.233 (0.667–2.280)	0.503
≥ 60,000	46 (93.9)	8.625 (2.615–28.453)	< 0.001	3.130 (0.874–11.217)	0.080
Health insurance					
UEBMI	37 (84.1)	2.954 (1.104–7.900)	0.031	1.885 (0.583–6.095)	0.290
URBMI	76 (83.5)	2.831 (1.287–6.230)	0.010	2.454 (0.950–6.338)	0.064
NRCMS	140 (62.8)	0.943 (0.505–1.759)	0.853	1.038 (0.499–2.156)	0.921
Not covered by national schemes	34 (64.2)	1.000		1.000	
Current smoker					
Yes	27 (67.5)	1.000		——	
No	260 (70.1)	1.128 (0.561–2.266)	0.736		
Current use of contraception					
Yes	251 (72.8)	2.225 (1.298–3.816)	0.004	1.673 (0.865–3.235)	0.126
No	36 (54.5)	1.000		1.000	
Parity					
0	54 (84.4)	4.478 (2.121–9.456)	< 0.001	2.096 (0.872–5.041)	0.098
1	151 (76.6)	2.722 (1.717–4.315)	< 0.001	1.554 (0.895–2.697)	0.117
≥ 2	82 (54.7)	1.000		1.000	
Clinical variables related to HIV infection					
Duration of ART (years)					
< 2	45 (55.6)	1.000		1.000	
≥ 2	195 (75.6)	2.476 (1.469–4.174)	0.001	1.906 (1.005–3.612)	0.048
No record	47 (65.3)	1.504 (0.782–2.892)	0.221	1.216 (0.523–2.827)	0.650
Most recent CD4 count (cells/μL)					
< 500	97 (64.2)	1.000		1.000	
≥ 500	163 (75.8)	1.745 (1.106–2.754)	0.017	1.236 (0.712–2.147)	0.451
No record	27 (60.0)	0.835 (0.422–1.653)	0.605	0.997 (0.253–3.920)	0.996
Most recent HIV VL (copies/mL)					
≤ 50	250 (72.3)	3.906 (1.354–11.269)	0.012	3.144 (0.787–12.557)	0.105
> 50	6 (40.0)	1.000		1.000	
No record	31 (62.0)	2.447 (0.752–7.967)	0.137	2.995 (0.536–16.748)	0.212

aOR adjusted odds ratio, *ART* antiretroviral therapy, *CD4* cluster of differentiation 4, *CI* confidence interval, *CNY* Chinese Yuan, *cOR* crude odds ratio, *HIV* human immunodeficiency virus, *NRCMS* new rural cooperative medical scheme, *UEBMI* urban employee basic medical insurance, *URBMI* urban resident basic medical insurance, *VL* viral load

[a] The unmarried category is composed of single and divorced/widowed to avoid zero-cell count

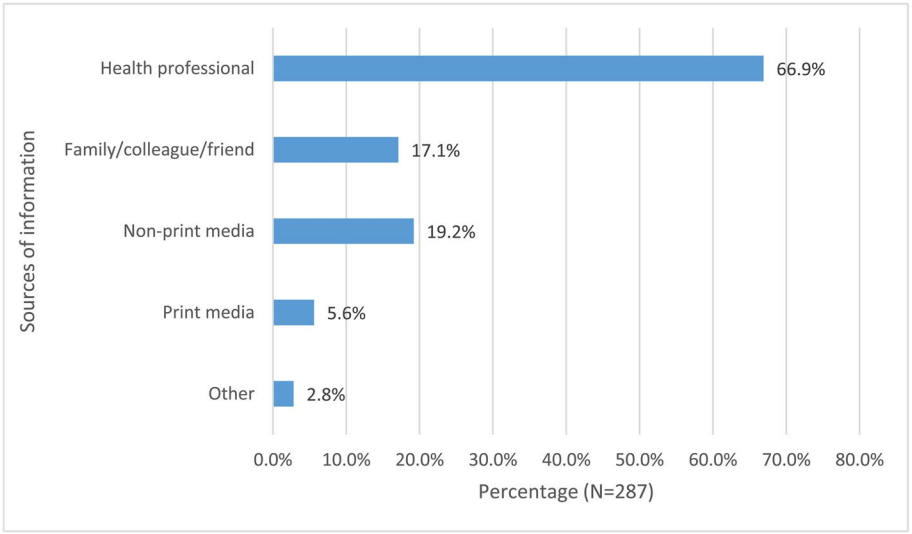

Fig. 1 Sources of information among participants aware of cervical cancer screening. Multiple choices were allowed

Cervical cancer screening attendance

A total of 163 (39.7%) women in our study had ever attended cervical cancer screening, of which 114 (27.7%) were screened within 3 years and thus were identified as having up-to-date screening attendance. The attendance for each 5-year age group are shown in Figure S1 (Additional file 2, Figure S1). None of the participants were diagnosed with invasive cervical cancer. As presented in Table 3, age, education, health insurance, and current smoking status were socio-demographic and behavioral factors significantly associated with up-to-date attendance. Compared to women aged more than 50 years, those aged 31–40 years (aOR = 4.861, 95% CI: 1.937–12.200) and 41–50 years (aOR = 4.489, 95% CI: 1.777–11.344) had a higher possibility to get up-to-date screening. Women accomplishing secondary education (aOR = 2.150, 95% CI: 1.214–3.806) were approximately two times more likely to get up-to-date screening versus those who received primary education or no formal education. In contrast with women not covered by any of the national health schemes, those covered by UEBMI (aOR = 4.386, 95% CI: 1.406–13.681) were more likely to get up-to-date screening. Current non-smokers (aOR = 3.130, 95% CI: 1.206–8.126) had elevated odds of up-to-date attendance compared to their smoking counterparts. Regarding variables related to HIV infection, women with an ART duration of ≥ 2 years (aOR = 2.411, 95% CI: 1.129–5.151) were more likely to have up-to-date attendance (Table 3).

Post-health education attitudes toward cervical cancer screening

Having received health education, 297 (72.3%) participants exhibited a positive attitude toward cervical cancer screening. In the multivariate analysis, women aged 31–40 years (aOR = 1.880, 95% CI: 1.006–3.513) were more likely to display a positive attitude than those aged more than 50 years. Compared to the married or cohabiting population, single women (aOR = 0.260, 95% CI: 0.089–0.761) tended not to show a positive attitude (Table 4). Among 297 participants with a positive attitude, health promotion activity was predominantly mentioned by 93.6% as a facilitating factor. Good organization was mentioned by 13.5% of the participants. Other perceived facilitators included free-of-charge or low-cost service (4.7%), reduction in the frequency of screening (3.0%), and option of self-sampling (2.4%) (Fig. 2a). Among 114 participants who did not have a positive attitude, approximately half identified high cost (55.3%) and inadequate awareness (50.0%) as barriers. Additionally, doubt about the safety of operation in medical procedures (30.7%), low perception of risk (29.8%), and physical discomfort (28.1%) were essential obstacles proposed by more than a quarter of the women (Fig. 2b).

Discussion

In this study, we estimated the awareness, previous attendance, and attitudes toward cervical cancer screening and identified the influencing factors among HIV-positive women attending a large ART clinic in Yunnan province, China. Although more than two-thirds (69.8%) of the women in our study were aware of cervical cancer screening, less than one-third (27.7%) had an up-to-date screening attendance. Age, education, health insurance, current smoking status, and duration of ART were factors affecting up-to-date screening attendance. Most women expressed a positive attitude toward the screening after

Table 3 Factors associated with up-to-date attendance of cervical cancer screening

Variables	Up-to-date attendance *N* (%)	Univariate analysis		Multivariate analysis	
		cOR (95% CI)	*p* value	aOR (95% CI)	*p* value
Socio-demographic and behavioral variables					
Age (years)					
≤ 30	8 (20.5)	2.618 (0.872–7.853)	0.086	2.192 (0.632–7.597)	0.216
31–40	57 (35.4)	5.559 (2.398–12.889)	< 0.001	4.861 (1.937–12.200)	0.001
41–50	42 (31.6)	4.681 (1.984–11.043)	< 0.001	4.489 (1.777–11.344)	0.001
> 50	7 (9.0)	1.000		1.000	
Marital status					
Single	7 (43.8)	2.130 (0.762–5.953)	0.149	——	
Divorced/widowed	42 (27.6)	1.046 (0.663–1.648)	0.848		
Married/cohabiting	65 (26.7)	1.000			
Occupational status					
Employed	52 (25.1)	0.768 (0.498–1.185)	0.233	——	
Unemployed	62 (30.4)	1.000			
Education					
≤ Primary	24 (17.0)	1.000		1.000	
Secondary	72 (31.7)	2.265 (1.345–3.811)	0.002	2.150 (1.214–3.806)	0.009
Tertiary	18 (41.9)	3.510 (1.661–7.418)	0.001	1.958 (0.773–4.963)	0.157
Annual household income (CNY)					
< 30,000	67 (24.4)	1.000		1.000	
30,000–59,999	27 (31.0)	1.397 (0.821–2.376)	0.217	1.195 (0.661–2.159)	0.555
≥ 60,000	20 (40.8)	2.141 (1.137–4.031)	0.018	1.119 (0.516–2.428)	0.776
Health insurance					
UEBMI	19 (43.2)	4.275 (1.637–11.164)	0.003	4.386 (1.406–13.681)	0.011
URBMI	29 (31.9)	2.631 (1.100–6.291)	0.030	2.166 (0.833–5.632)	0.113
NRCMS	58 (26.0)	1.977 (0.880–4.442)	0.099	2.000 (0.843–4.741)	0.116
Not covered by national schemes	8 (15.1)	1.000		1.000	
Current smoker					
Yes	6 (15.0)	1.000		1.000	
No	108 (29.1)	2.327 (0.950–5.703)	0.065	3.130 (1.206–8.126)	0.019
Current use of contraception					
Yes	99 (28.7)	1.368 (0.735–2.547)	0.322	——	
No	15 (22.7)	1.000			
Parity					
0	24 (37.5)	2.212 (1.167–4.193)	0.015	1.701 (0.812–3.566)	0.159
1	58 (29.4)	1.539 (0.937–2.528)	0.089	1.144 (0.654–2.000)	0.638
≥ 2	32 (21.3)	1.000		1.000	
Clinical variables related to HIV infection					
Duration of ART (years)					
< 2	11 (13.6)	1.000		1.000	
≥ 2	79 (30.6)	2.809 (1.411–5.592)	0.003	2.411 (1.129–5.151)	0.023
No record	24 (33.3)	3.182 (1.426–7.100)	0.005	2.414 (0.964–6.041)	0.060
Most recent CD4 count (cells/μL)					
< 500	32 (21.2)	1.000		1.000	
≥ 500	68 (31.6)	1.720 (1.059–2.793)	0.028	1.600 (0.933–2.744)	0.088
No record	14 (31.1)	1.679 (0.800–3.527)	0.171	2.040 (0.785–5.306)	0.144
Most recent HIV VL (copies/mL)					
≤ 50	98 (28.3)	2.569 (0.569–11.592)	0.220	——	
> 50	2 (13.3)	1.000			
No record	14 (28.0)	2.528 (0.504–12.667)	0.259		

aOR adjusted odds ratio, *ART* antiretroviral therapy, *CD4* cluster of differentiation 4, *CI* confidence interval, *CNY* Chinese Yuan, *cOR* crude odds ratio, *HIV* human immunodeficiency virus, *NRCMS* new rural cooperative medical scheme, *UEBMI* urban employee basic medical insurance, *URBMI* urban resident basic medical insurance, *VL* viral load

Table 4 Factors associated with post-health education positive attitude toward cervical cancer screening

Variables	Positive attitude *N* (%)	Univariate analysis		Multivariate analysis	
		cOR (95% CI)	*p* value	aOR (95% CI)	*p* value
Socio-demographic and behavioral variables					
Age (years)					
≤ 30	24 (61.5)	0.947 (0.429–2.090)	0.893	1.102 (0.455–2.671)	0.830
31–40	123 (76.4)	1.916 (1.066–3.441)	0.030	1.880 (1.006–3.513)	0.048
41–50	101 (75.9)	1.868 (1.018–3.429)	0.044	1.656 (0.880–3.118)	0.118
> 50	49 (62.8)	1.000		1.000	
Marital status					
Single	7 (43.8)	0.255 (0.091–0.714)	0.009	0.260 (0.089–0.761)	0.014
Divorced/widowed	107 (70.4)	0.893 (0.533–1.496)	0.668	0.834 (0.515–1.349)	0.458
Married/cohabiting	183 (75.3)	1.000		1.000	
Occupational status					
Employed	147 (71.0)	0.882 (0.572–1.359)	0.569	——	
Unemployed	150 (73.5)	1.000			
Education					
≤ Primary	96 (68.1)	1.000		——	
Secondary	167 (73.6)	1.305 (0.823–2.069)	0.258		
Tertiary	34 (79.1)	1.771 (0.783–4.003)	0.170		
Annual household income (CNY)					
< 30,000	192 (69.8)	1.000		——	
30,000–59,999	66 (75.9)	1.359 (0.780–2.365)	0.279		
≥ 60,000	39 (79.6)	1.686 (0.804–3.537)	0.167		
Health insurance					
UEBMI	34 (77.3)	1.749 (0.707–4.325)	0.227	1.688 (0.658–4.328)	0.276
URBMI	73 (80.2)	2.086 (0.968–4.494)	0.061	1.831 (0.816–4.110)	0.143
NRCMS	155 (69.5)	1.172 (0.621–2.214)	0.624	1.083 (0.560–2.094)	0.813
Not covered by national schemes	35 (66.0)	1.000		1.000	
Current smoker					
Yes	27 (67.5)	1.000		——	
No	270 (72.8)	1.287 (0.639–2.592)	0.480		
Current use of contraception					
Yes	255 (73.9)	1.619 (0.928–2.823)	0.089	1.530 (0.850–2.756)	0.157
No	42 (63.6)	1.000		1.000	
Parity					
0	42 (65.6)	0.625 (0.331–1.180)	0.147	——	
1	142 (72.1)	0.845 (0.521–1.372)	0.497		
≥ 2	113 (75.3)	1.000			
Clinical variables related to HIV infection					
Duration of ART (years)					
< 2	55 (67.9)	1.000		——	
≥ 2	189 (73.3)	1.295 (0.753–2.226)	0.350		
No record	53 (73.6)	1.319 (0.654–2.660)	0.440		
Most recent CD4 count (cells/μL)					
< 500	108 (71.5)	1.000		——	
≥ 500	159 (74.0)	1.130 (0.709–1.802)	0.606		
No record	30 (66.7)	0.796 (0.390–1.625)	0.531		
Most recent HIV VL (copies/mL)					
≤ 50	255 (73.7)	1.000		——	
> 50	9 (60.0)	0.535 (0.185–1.546)	0.248		
No record	33 (66.0)	0.693 (0.368–1.304)	0.255		

aOR adjusted odds ratio, *ART* antiretroviral therapy, *CD4* cluster of differentiation 4, *CI* confidence interval, *CNY* Chinese Yuan, *cOR* crude odds ratio, *HIV* human immunodeficiency virus, *NRCMS* new rural cooperative medical scheme, *UEBMI* urban employee basic medical insurance, *URBMI* urban resident basic medical insurance, *VL* viral load

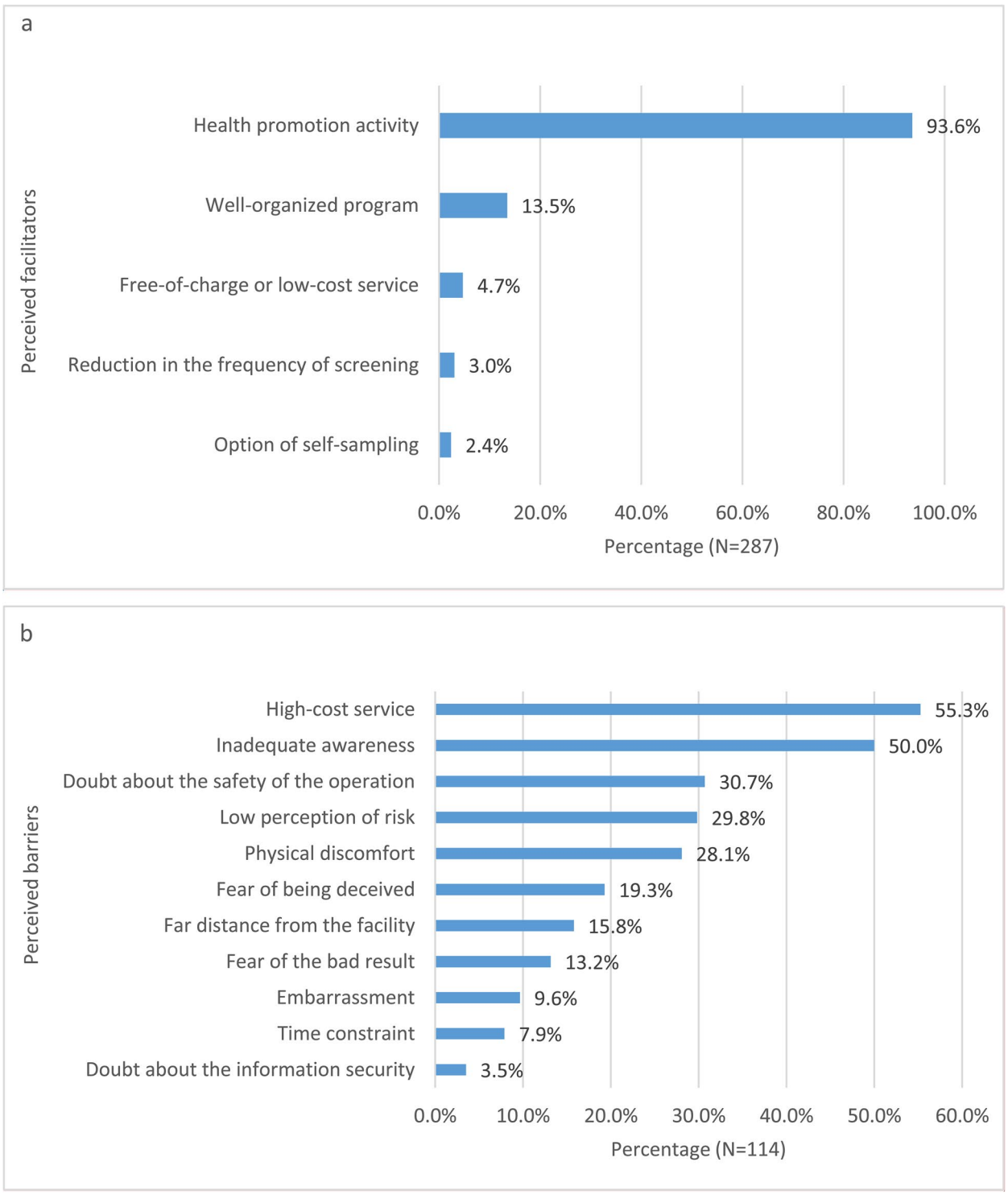

Fig. 2 Perceived facilitators and barriers to attending cervical cancer screening. **a** Perceived facilitators to attending cervical cancer screening among participants showing a positive attitude toward cervical cancer screening. **b** Perceived barriers to attending cervical cancer screening among participants not showing a positive attitude toward cervical cancer screening

receiving health education, with married or cohabiting ones tending to be more positive than single ones. However, prevailing barriers, mainly including high cost service and inadequate awareness, should also be addressed.

Previous cervical cancer screening attendance among HIV-positive Chinese women was poor. Only 27.7% were screened within 3 years, consistent with the sole study conducted among HIV-positive women in Hunan province (28.2%) [19]. Precedent studies suggested that clinic visit and information on cervical cancer and its screening from the clinic were promoting factors of the screening attendance among HIV-positive women [26, 27]. Therefore, the up-to-date attendance might be even lower among the whole HIV-positive women population, particularly those who do not regularly attend the HIV/AIDS clinics or the department of infectious diseases. The up-to-date attendance among HIV-positive Chinese women was lower than that of those in the United States (US) (85.7%) [26] and Ontario, Canada (58%) [28]. Though the cervical cancer screening attendance in the US study was determined by self-reported information and thus might be overestimated, the Ontario study, similar to ours, captured the attendance by medical records. The discrepancy between HIV-positive women in China and North America may partly be attributed to variations in health policies: community-based health centers in the US provide free-of-charge comprehensive healthcare for financially constrained HIV-positive women [26], and Pap tests in Ontario are covered by the Ontario Health Insurance Plan [29]. On the contrary, there is no specific screening algorithm and policy for HIV-positive Chinese women, and it was not until 2022 that both urban and rural females aged 35–64 were included in the national cervical cancer screening program [30]. Due to the increased risk of cervical precancerous lesions and cancers, it has been recognized that HIV-positive women should have a shorter screening interval [31]. The WHO called for 3–5-yearly regular screening with a coverage of 70% among HIV-positive women to attenuate the burden of cervical cancer [15]. Guidelines of other organizations also recommended screening intervals not longer than 3 years for HIV-positive women [32–35]. Since neither the lifetime nor the up-to-date attendance exceeded 50% in any age group in our study, a huge gap toward the target is left to be filled in less than a decade for this vulnerable population in China.

From the individual perspective, it is vital to enhance awareness to promote the screening attendance. The awareness rate of cervical cancer screening among women in our study was 69.8%, lower than that of those in African regions, including Kisumu, Kenya (99.0%) [36]; Kampala, Uganda (98.0%) [37]; Luderitz, Namibia (93.4%) [38]; Kilimanjaro Region, Tanzania (89.6–90%) [39]; and some regions in Ethiopia (37.8–87.7%) [20, 40–43]. A target awareness rate of 80% regarding key knowledge of cancer prevention and control was put forward in the Work Plan for Cervical Cancer Screening [30] and Healthy China Initiative: Implementation Plan for Cancer Prevention and Control (2023–2030) [44] issued by the National Health Commission. The existing gap highlights the necessity of health education and promotion. We also found the most frequently mentioned facilitator among women in our study with a positive attitude toward cervical cancer screening was health promotion activity, and inadequate awareness was an essential barrier, which further substantiated the indispensable role of health education and promotion. To enhance the impact of health education, feasible and efficient channels should be explored. Analogous to prior studies [20, 36, 37, 41, 43], health professionals were the main source of information. The recommendation from health professionals dramatically promoted cervical cancer screening attendance among HIV-positive women [37, 45]. Under this circumstance, it is crucial to popularize the information about gynecological cancer screening among healthcare providers and to nurture their awareness of making recommendations for women at appropriate ages. For HIV-positive women, healthcare providers should inform them of the elevated risk they encounter and emphasize the necessity for shorter screening intervals. Non-print media was opted by less than 20% as an information source, much lower than anticipated but comparable to previous studies [36, 37, 41, 43]. On the contrary, social media, one of the non-print media channels, was identified by 60% of the common Chinese females as an information source [46]. This disparity illuminated the fact that HIV-positive women, as a special population, did not gain additional, or even equal, attention in public health education compared to common females. Mass media including social media, mobile applications, television, and radio should be efficiently utilized to disseminate health information. This effort should be supported by professional institutions to improve citizens' awareness, with vulnerable populations being prioritized and ensuring they are not ignored or left behind.

To carry out health education and promotion, our study suggests that women with a lower education background, current smoking, and receiving ART for a short duration should be regarded as priority population groups. In line with preceding studies, HIV-positive women with higher education were more likely to be aware of cervical cancer screening [47, 48] and to have attended the screening [27, 48–52]. According to the Ministry of Education of China [53], health education on cancer and HIV/AIDS prevention was designed for students attending junior and senior high schools rather than primary school.

The deprivation of the accessibility to health knowledge among women with inadequate literacy might impede their health consciousness. Current smokers had a lower possibility of getting up-to-date screening, in agreement with a study from a Swiss HIV cohort [54]. This association could be explained by the variation of health consciousness among people with different smoking statuses [55], which implies that female current smokers may also seek less gynecologic healthcare. A longer duration of ART was a promoting factor of both awareness and attendance of the screening, aligned with preceding studies [47, 52]. HIV-positive women with prolonged duration of ART would have more contact with healthcare providers and access to health information, which could fortify health literacy and promote health behaviors. In addition to the women themselves, their spouses should also be considered in health education. HIV-positive women with a positive attitude toward cervical cancer screening were more likely to attend the screening in contrast to those with a negative attitude [21, 56]. Our study revealed that a married or cohabiting status was a promoting factor of positive attitude, commensurate with prior studies conducted among the common female population [46, 57]. Chigbu et al. [58] implied that family and spousal support would motivate females to attend cervical cancer screening. Therefore, health education and promotion should also be provided for males to raise their awareness and willingness to socially and financially support spouses and female family members to attend healthcare services.

The prominent discrepancy between the awareness rate and attendance rate and the unique factors associated with attendance underpin the importance of adopting public policies to further enhance participation. Regarding screening algorithms, HIV-positive women at an older age should not be overlooked. Compared to participants aged more than 50 years, those in younger age groups had higher attendance, resembling studies in the US that found older age was associated with non-adherence to cervical cancer screening [59, 60]. The WHO suggests a termination at 50 years after 2 consecutive screenings with negative results, but it advocates that HIV-positive women aged 50–65 years never screened before should be prioritized [61]. The lifetime screening rate among women in our study was low, and the aforementioned study implied a higher proportion of cervical HPV infection among HIV-positive Chinese women aged more than 50 years than that of younger age groups [14]. Regarding funding and subsidy, HIV-positive women with inadequate health insurance and those financially constrained should be prioritized. Women in our study covered by UEBMI have higher up-to-date screening attendance compared to those not covered by national health schemes, while URBMI and NRCMS attendees had non-significant higher attendance. Similarly, a study in the US illustrated that cervical cancer screening attendance among females with inadequate and no health insurance decreased by 1% and 9%, respectively [62]. Lee et al. [63] categorized UEBMI, URBMI, and NRCMS into the high, medium, and low coverage groups by their reimbursement proportions of medical expenses (80%, 50–80%, and < 50%). A declining trend in the attendance of physical exams was observed among citizens covered by UEBMI, URBMI, NRCMS, and those with no health insurance. In accordance with the results in the attendance, we also found that high-cost service was the most frequently mentioned barrier among women who did not show a positive attitude toward the screening. These results implicate that health insurance and financial status might impact the accessibility to health services. However, the existing rules for medical reimbursement among common females vary a lot for different screening methods, medical facilities, and geographical regions with a disproportional focus on therapy rather than screening. It is vital to develop specific screening and management algorithms for HIV-positive Chinese women and assess the long-term effects and cost-effectiveness. Government-funded, employer-sponsored, and commerce-supported health insurance and subsidizing strategies should be further developed to formulate a robust and comprehensive system covering screening and management for precancerous cervical lesions. Affordable and accessible services should be proffered to avoid more advanced cancers and attain health equity.

Despite an unsatisfactory previous screening attendance, more than 70% of the participants displayed a positive attitude toward cervical cancer screening after receiving the brief health education. Aside from the issues addressable by aforementioned health education and public policies, optimizing the organization and implementation of the screening projects may also conduce to women's willingness to attend the screening. In our study, good organization was the second most frequently mentioned facilitator. This suggests the necessity of establishing comprehensive and convenient procedures for cervical cancer screening and management for HIV-positive women. Since the community also plays a role in encouraging females to attend cervical cancer screening [58], for HIV-positive women lacking support from a spouse or family, the involvement of the employment unit and community is fundamental. Physical exams organized by the employment unit facilitated the attendance of cervical cancer screening [64], and a community-based screening program may serve as a promising model for mass screening, especially for females in remote and resource-limited regions [65]. Besides,

integrating the control of HIV/AIDS and cervical cancer is also worth considering, which has been endorsed by the WHO and verified to be feasible and accessible by practice in Africa [66]. A viable strategy in mainland China is to promote the involvement of infectious diseases departments or hospitals and HIV/AIDS clinics in cervical cancer screening. Based on the number of HIV-infected women at appropriate ages in each administrative region, a certain proportion of the screening quotas for breast and cervical cancers in the nationally organized screening program can be allocated to the aforementioned institutions for HIV/AIDS healthcare. In addition, institutions for HIV/AIDS healthcare can routinely offer services for cervical cancer prevention and treatment if conditions permit [67]. This strategy can effectively promote the attendance of cervical cancer screening among HIV-positive women [27, 59].

To construct a comprehensive healthcare system combining HIV/AIDS and cervical cancer control in China, promoting the HPV vaccination is also crucial in addition to the screening. Though evidence on clinical efficacy and effectiveness of HPV vaccination on HIV-positive women is yet to be established, existing studies have confirmed its safety and immunogenicity in people living with HIV [68]. WHO advocates that HPV vaccination for this population should be prioritized in public health program, and that they should receive a 3-dose or at least 2-dose vaccination regardless of the age, status of ART or HPV infection [69]. Children of HIV-positive women may also benefit from the protection against HPV genotypes contained in the vaccines. For instance, children of HIV-positive women might encounter an elevated risk of juvenile-onset recurrent respiratory papillomatosis (JoRRP) due to the increased possibility of vertical transmission of HPV [70]. JoRRP carries the risk of airway obstruction and malignant transformation and brings significant economic and psychological burden [71]. Studies in the US and Australia both reported a significant decline in the incidence of JoRRP after the introduction of HPV vaccination, implying the indispensable role of HPV vaccination in the elimination of JoRRP [72, 73]. Therefore, HPV vaccination could be advantageous for both HIV-positive women and their children in preventing HPV-related diseases. Following the launch of Health City Innovation Pilot Program targeting cervical cancer control in 2021, many cities in China have developed innovative strategies in cervical cancer screening techniques and implementation. Additionally, as of 2023, more than 40 regions have initiated HPV vaccination programs funded by the government or enterprises for women at appropriate ages [74]. These measures will help alleviate the risk of HPV-related diseases for HIV-positive Chinese women and their children and improve health equity in the future.

To the best of our knowledge, we are the first to have evaluated the awareness, attendance, and attitudes toward cervical cancer screening with their associated factors among HIV-positive women attending a large ART clinic in an HIV-endemic province in China. Our study could provide insights into cervical cancer prevention and management among this vulnerable population in HIV-endemic regions. However, the existing limitations should also be noted. Firstly, this was a monocenter study and we did not use the random sampling method. Besides, the sample size was determined based on the primary objective of the main study rather than specifically calculated for this sub-study, though a desired power could be obtained based on the assumptions and the given sample size. These aspects made us cautious to interpret and generalize the results. Future studies elaborately designed for this topic among a broader population of HIV-positive Chinese women could contribute to more in-depth insights into cervical cancer prevention and control. Secondly, it was a cross-sectional study; therefore, the results could only implicate an association between dependent and independent variables rather than establish causality. Thirdly, despite a face-to-face survey conducted by well-trained health workers, recall and social desirability biases inevitably existed in self-reported information.

Conclusions

In summary, our study found that most HIV-positive women attending a large ART clinic in Yunnan, China were aware of cervical cancer screening, but the up-to-date screening attendance was suboptimal. Health education and promotion should be provided to women and their spouses, particularly those with limited health literacy and consciousness. Efficient channels, involving health professionals and mass media, should be harnessed to raise awareness in cancer prevention engagement. Besides, applicable screening algorithms, effective public policies, and optimized organization should also be developed to further encourage their willingness towards and active participation in the screening. In addition, commencement of HPV vaccination in China may also play an essential role in preventing HPV-related diseases for HIV-positive women and their children. It is critical to construct a robust system of cervical cancer prevention integrated with HIV/AIDS healthcare in China to meet the target in the context of cervical cancer elimination.

Supplementary Information

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Additional file 1: Questionnaire form.

Additional file 2: Figure S1. Cervical cancer screening attendance according to age group.

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Authors' contributions
JWH and RFD planned and designed the study. RFD, HYZ, XLZ, and FHZ designed the questionnaire. RFD, AHW, and LL conducted the interview and collected the data. JWH analyzed and interpreted the data, and wrote the manuscript. XLZ, FHZ, and YZ revised the manuscript. FHZ and YZ supervised the study and provided conceptual assistance. All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare no competing interests.

Ethics approval and consent to participate
Ethical approval was obtained from the Ethics Committee of the National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China (Approval Number: 17–205/1461). All participants in this study were voluntary and provided written informed consent. All methods were performed following relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
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