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Preplanned Studies

Diagnosis, Treatment, and Associated Factors Among Patients with HCV Infection — Jiangsu Province, China, 2004–2020

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Summary

What is already known on this topic?

The global efforts to address the hepatitis C virus (HCV) are progressing, but there are still significant gaps in the diagnosis and treatment of HCV, leading to an increasing number of deaths related to HCV.

What is added by this report?

An extensive investigation was conducted to assess HCV RNA diagnosis, treatment uptake, and associated factors among individuals infected with HCV within Jiangsu Province. The study encompassed a large geographical area and utilized a substantial sample size.

What are the implications for public health practice?

Implementing focused interventions to improve the timely diagnosis of HCV RNA and increase the uptake of HCV treatment could effectively reduce the future burden of HCV-related health problems, deaths, and healthcare expenses. This is essential for achieving the global target of eliminating hepatitis C.

Hepatitis C virus (HCV) infection remains a significant global health issue. WHO has set targets of diagnosing 90% of HCV patients and treating 80% of eligible patients to globally eliminate hepatitis C by 2030. However, China currently carries the highest burden of HCV infection worldwide. Alarmingly, estimates indicate that only 18% of the HCV-infected population in China had been diagnosed, and less than 1.3% received treatment in 2016 (*1*–*2*).

To investigate HCV-RNA testing, antiviral treatment (ART) uptake, and risk factors among HCV-infected individuals, a retrospective survey was conducted in Jiangsu Province from 2004 to 2020. Our findings revealed that the rates of HCV-RNA testing and ART were only 51.3% and 38.7%, respectively, falling short of the WHO's elimination targets. Several factors were associated with HCV-RNA testing and treatment uptake, including education level, awareness of HCV-related knowledge, exposure history, and residential location. Age, gender, presence of clinical symptoms, and previous HCV-RNA testing also impacted treatment uptake. These results highlight the need for improving HCV-related advocacy, innovating diagnostic strategies, and increasing access to ART.

A stratified and multi-stage cluster survey was performed among individuals with HCV infection aged 18 and above in four cities, including Xuzhou, Wuxi, Yancheng, and Zhenjiang. The semi-structured questionnaire covered the following areas: 1) Demographic characteristics, including gender, age, education level, marital status, occupation, monthly income, health insurance, and HCV-related knowledge; 2) HCV infection risk factors, such as blood transfusion, tattooing, drug abuse, needle sharing, dialysis, unprotected commercial sex, and living with hepatitis-infected individuals; and 3) HCV-RNA testing and ART regimens. All participants underwent HCV serological screening to confirm positive anti-HCV antibody status for eligibility. Demographic characteristics and HCV risk factors were sourced from the China Information System for Disease Prevention and Control (CISFDPC), while data on HCV-RNA testing and ART were obtained from medical records or participant recall. Participants provided written, fully informed consent. The study was approved by the institutional review boards at the National Center for AIDS/STD Control and Prevention, China CDC (Approval No. 210827664, 08/27/2021).

Statistical analysis was conducted using IBM SPSS Statistics software (version 26.0; IBM Corporation, Armonk, NY, USA). Statistical significance was defined as $P<0.05$. The univariable and multivariable logistic analyses were performed to examine factors associated with HCV-RNA testing and ART uptake.

Out of the total of 3,786 participants, 741 were excluded from the study, including inaccessibility due to Corona Virus Disease 2019 pandemic restrictions (n=32), death (n=164), refusal to participate (n=36),

and negative serological antibody screening results (*n*=509). The baseline characteristics of remaining 3,045 participants are presented in Supplementary Table S1 (available in https://weekly.chinacdc.cn/).

Out of the total 3,045 participants, 1,908 participants (62.7%) were passively screened for HCV by targeting high-risk populations, while only 1,137 (37.3%) actively underwent anti-HCV testing when they exhibited clinical symptoms. A total of 2,417 (79.4%) participants reported engaging in HCV risk behaviors, including unsafe treatment or tattoo(s) (43.5%), blood transfusion or renal cell transplant (22.7%), commercial blood donation (6.8%), intravenous drug abuse or commercial sexual behavior or living with HCV infected person(s) (5.8%), and mother-to-child transmission (0.5%). About half of the participants (59.9%) participants demonstrated awareness of HCV-related knowledge, defined as correctly answering 6 out of 8 HCV-related knowledge questions. HCV-RNA testing was conducted on 1,563 (51.3%) participants, and 1,179 (38.7%) received ART. Factors contributing to not receiving ART included being asymptomatic (26.1%), unaffordable treatment costs (22.1%), failure to deliver ART (4.3%), and unknowing HCV infection status (6.6%).

Table 1 shows the multivariable analysis results of HCV-RNA testing. High school graduate or above [odds ratio (*OR*)=1.33, 95% confidence interval (*CI*): 1.10–1.61], better awareness of HCV-related knowledge (*OR*=1.41, 95% *CI*: 1.21–1.64), the history of blood transfusion or cell transplant (*OR*=1.21, 95% *CI*: 1.01–1.44), and the history of mother-to-child transmission (*OR*=4.34, 95% *CI*: 1.21–15.57) were associated with increased odds of undergoing HCV RNA testing. Additionally, residing in Yancheng (*OR*=1.24, 95% *CI*: 1.03–1.50) was significantly associated with receiving HCV-RNA testing, while residing in Zhenjiang (*OR*=0.76, 95% *CI*: 0.57–0.99) was significantly associated with not taking HCV-RNA testing.

Supplementary Table S2 (available in https://weekly.chinacdc.cn/). presents the results of the analysis result about factors related to receiving ART, which include having high school degree or above (*OR*=1.49, 95% *CI*: 1.17–1.89), experiencing clinical symptoms of hepatitis C (*OR*=1.50, 95% *CI*: 1.27–1.77), having better awareness of HCV-related knowledge (*OR*=1.64, 95% *CI*: 1.39–1.94), undergoing HCV RNA testing (*OR*=3.48, 95% *CI*: 2.96–4.10), having history of blood transfusion, cell transplant (renal), or dialysis (*OR*=1.52, 95% *CI*: 1.26–1.84), and having history of commercial blood donation (*OR*=1.51, 95% *CI*: 1.10–2.27). However, being 75 years or older (*OR*=0.60, 95% *CI*: 0.41–0.90) and being female (*OR*=0.79, 95% *CI*: 0.67–0.93) were factors that hindered HCV ART.

DISCUSSION

China initiated the National Work Plan for Elimination of Hepatitis C as a Public Health Threat (2021–2030) in 2021 (*3*), which emphasizes the significance of HCV diagnosis and treatment.

In this study, we found that only 51.3% of participants with HCV antibody-positive underwent HCV-RNA testing. This rate was higher than the national average level (18%) (*2*) , similar to studies conducted in the USA (50%) (*4*), but lower than rates in Brazil (67.7%) (*5*), the Republic of Korea (70%) (*6*), and the global goal (90%). Participants with low educational levels and poor awareness of HCV-related knowledge had a lower testing rate. Previous studies have shown that some patients only seek testing when they experience clinical symptoms and seek medical advice (*7*). This pattern was also evident in this study, as the majority of participants with HCV antibody positive (62.7%) were screened through high-risk populations, while only 37.3% were tested due to clinical symptoms of HCV. The low awareness of HCV, combined with its asymptomatic nature, contributes to a reduced focus on the hidden hazards of HCV. Furthermore, our study revealed that individuals with a history of clinical blood transfusion, organ transplantation, or mother-to-child transmission were more likely to have detectable HCV-RNA. This could be attributed to the increased awareness of HCV among healthcare providers in China. Previous research has demonstrated that interventions aimed at healthcare practitioners are effective in increasing screening rates and identifying HCV-infected patients (*7*). Thus, enhanced public awareness and education, particularly among high-risk populations and general practitioners, should be focused.

Our study discovered that only 1,179 (38.7%) individuals had received ART prior to entering the study, which falls well below the global elimination target of 80% for eligible individuals with positive HCV RNA. Previous evidence has also indicated low rates of HCV treatment uptake worldwide, with average rates of 1.3% in China (*2*), 34.1% in Brazil (*5*), and 28% in the U.S. (*8*). This study indicates that a higher level of education and greater awareness of

TABLE 1. Univariable and multivariable analysis assessing characteristics associated with having conducted testing for HCV RNA.

Factor	Univariable analysis			Multivariable analysis		
	OR	95% *CI*	*P* value	*OR*	95% *CI*	*P* value
Age group (years)						
18–45		1.00 (Ref)				
46–55	0.9	(0.72, 1.14)	0.381			
56–65	0.95	(0.76, 1.18)	0.619			
66–75	0.81	(0.65, 1.01)	0.065			
≥75	0.75	(0.55, 1.02)	0.070			
Gender						
Male		1.00 (Ref)				
Female	0.87	(0.76, 1.01)	0.062			
Employment						
Unemployed		1.00 (Ref)				
Employed	1.22	(0.99, 1.50)	0.064			
Students and others	1.19	(0.86, 1.65)	0.287			
Education level						
Under elementary graduate		1.00 (Ref)			1.00 (Ref)	
Secondary graduate	1.02	(0.86, 1.20)	0.860	1.04	(0.88, 1.23)	0.648
Above high school graduate	1.33	(1.11, 1.60)	0.002	1.33	(1.10, 1.61)	0.004
Marital status						
Single/separated/divorced/widowed		1.00 (Ref)				
Living together/married	0.95	(0.76, 1.18)	0.616			
Residence						
Xuzhou City		1.00 (Ref)			1.00 (Ref)	
Wuxi City	0.79	(0.66, 0.94)	0.007	0.72	(0.60, 0.87)	<0.001
Yancheng City	1.19	(0.99, 1.44)	0.067	1.24	(1.03, 1.50)	0.026
Zhenjiang City	0.76	(0.58, 0.99)	0.043	0.76	(0.57, 0.99)	0.046
Income level						
≤3,000 CNY/month		1.00 (Ref)				
>3,000 CNY/month	1.17	(1.00, 1.36)	0.049			
Health insurance						
No		1.00 (Ref)				
Yes	0.98	(0.64, 1.51)	0.935			
Reasons for HCV antibody testing						
High-risk population passive screening & others		1.00 (Ref)				
Showed clinical symptoms of hepatitis C	1.03	(0.89, 1.19)	0.743			
Awareness of HCV related knowledge						
No		1.00 (Ref)			1.00 (Ref)	
Yes	1.41	(1.22, 1.64)	<0.001	1.41	(1.21, 1.64)	<0.001
Having history of unsafe treatment (sharing needles, experience of dental clinic, endoscope examination) or tattoo (s)						
No		1.00 (Ref)				
Yes	1.08	(0.94, 1.25)	0.293			

Continued

Factor	Univariable analysis			Multivariable analysis		
	OR	95% *CI*	*P* value	*OR*	95% *CI*	*P* value
Having history of blood transfusion (organ, tissue) or cell transplant (renal) dialysis						
No		1.00 (Ref)			1.00 (Ref)	
Yes	1.196	(1.01, 1.42)	0.04	1.21	(1.01, 1.44)	0.035
Having history of commercial blood donation						
No		1.00 (Ref)				
Yes	0.906	(0.68, 1.20)	0.493			
Having history of intravenous drug abuse, sexual intercourse with sex workers or living with person (s) infected with HBV/HCV						
No		1.00 (Ref)				
Yes	1.040	(0.77, 1.41)	0.801			
Mother to child transmission						
No		1.00 (Ref)			1.00 (Ref)	
Yes	3.814	(1.07,13.54)	0.038	4.34	(1.21, 15.57)	0.024

Abbreviation: Ref=reference; *OR*=odds ratio; *CI*=confidence interval; CNY=Chinese Yuan; HCV=hepatitis C virus; HBV=hepatitis B virus; RNA=ribonucleic acid.

HCV-related knowledge can enhance the ART uptake among individuals with HCV infection. Furthermore, 26.1% of participants who did not undergo ART were asymptomatic and failed to undergo further HCV RNA testing. This finding is consistent with a prior study suggesting that asymptomatic HCV patients typically undergo anti-HCV testing and treatment only when they exhibit clinical symptoms (*7*).

In China, HCV-RNA testing is not widely available in primary healthcare institutions. The current two-step HCV diagnosis process in China is time-consuming and can result in patients being lost to follow-up after positive antibody testing. Moreover, the high cost of HCV-RNA detection makes it unaffordable for low-income patients. These factors hinder timely HCV diagnosis and delay early treatment. Recently, the WHO recommended performing HCV-RNA testing immediately after a positive HCV antibody test through a reflex test. This approach allows for a convenient and efficient single-visit HCV diagnosis. Therefore, it is crucial to develop innovative diagnostic strategies that ensure universal access and affordability of HCV-related testing.

Additionally, the study revealed a low prevalence of ART for hepatitis C among patients aged 75 years and older. Advanced age is a significant risk factor for liver fibrosis (*9*), and HCV-infected patients who are aged 50 years or older may develop cirrhosis within an average of 12 years if treatment is not initiated promptly (*10*). This finding highlights the need to enhance ART among the elderly population.

There are several limitations in this study. First, the retrospective design and use of a questionnaire survey may introduce information recall bias. Second, this study exclusively focused on the impact of individual patients on HCV RNA testing and ART uptake without considering the influence of healthcare providers or medical institutions.

In summary, there are significant deficiencies in the diagnosis and treatment of HCV compared to global targets. This entails increased advocacy and education to enhance public awareness of HCV for early antibody screening, diagnosis, and uptake of ART. Additionally, innovative diagnostic strategies are needed to identify more confirmed patients. Furthermore, we should enhance the coverage of ART for HCV-RNA-positive patients.

Conflicts of interest: No conflicts of interest.

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REFERENCES

1. The Polaris Observatory HCV Collaborators. Global change in hepatitis C virus prevalence and cascade of care between 2015 and 2020: a modelling study. Lancet Gastroenterol Hepatol 2022;7(5):396 – 415. http://dx.doi.org/10.1016/S2468-1253(21)00472-6.
2. Bian DD, Zhou HY, Liu S, Liu M, Duan C, Zhang JY, et al. Current treatment status and barriers for patients with chronic HCV infection in mainland China: A national multicenter cross-sectional survey in 56 hospitals. Medicine 2017;96(34):e7885. http://dx.doi.org/10.1097/MD.0000000000007885.
3. National Disease Control and Prevention Administration. The national work plan for elimination of hepatitis C as a public health threat (2021–2030). 2021. http://www.nhc.gov.cn/jkj/s3586/202109/c462ec94e6d14d8291c5309406603153.shtml. [2023-8-20]. (In Chinese).
4. Lebovics E, Torres R, Porter LK. Primary care perspectives on hepatitis C virus screening, diagnosis and linking patients to appropriate care. Amer J Med 2017;130(2):S1 – 2. http://dx.doi.org/10.1016/j.amjmed.2017.01.001.
5. Carvalho-Louro DM, Soares EB, Trevizoli JE, Marra TMG, da Cunha ALR, Rodrigues MP, et al. Hepatitis C screening, diagnosis, and cascade of care among people aged > 40 years in Brasilia, Brazil. BMC Infect Dis 2020;20(1):114. http://dx.doi.org/10.1186/s12879-020-4809-2.
6. Kim BK. How to optimize the care cascade of hepatitis C virus infection. Gut Liver 2022;16(6):809 – 10. http://dx.doi.org/10.5009/gnl220452.
7. Sun J, Cheng HC, Hassan MRA, Chan HK, Piedagnel JM. What China can learn from Malaysia to achieve the goal of "eliminate hepatitis C as a public health threat" by 2030 - a narrative review. Lancet Reg Health West Pac 2021;16:100261. http://dx.doi.org/10.1016/j.lanwpc.2021.100261.
8. Kapadia SN, Katzman C, Fong C, Eckhardt BJ, Guarino H, Mateu-Gelabert P. Hepatitis C testing and treatment uptake among young people who use opioids in New York City: A cross-sectional study. J Viral Hepatitis 2021;28(2):326 – 33. http://dx.doi.org/10.1111/jvh.13437.
9. Malnick S, Maor Y, Melzer E, Tal S. Chronic hepatitis C in the aged: much ado about nothing or nothing to do? Drugs Aging 2014;31(5):339 – 47. http://dx.doi.org/10.1007/s40266-014-0170-8.
10. Poynard T, Ratziu V, Charlotte F, Goodman Z, McHutchison J, Albrecht J. Rates and risk factors of liver fibrosis progression in patients with chronic hepatitis C. J Hepatol 2001;34(5):730 – 9. http://dx.doi.org/10.1016/S0168-8278(00)00097-0.

SUPPLEMENTARY TABLE S1. Characteristics of HCV antibody-positive participants.

Factor	Xuzhou City (*N*=1,256) *n* (%)	Wuxi City (*N*=867) *n* (%)	Yancheng City (*N*=672) *n* (%)	Zhenjiang City (*N*=250) *n* (%)	Total (*N*=3,045) *n* (%)
Age, mean±SD	57.84±13.83	55.44±12.93	60.24±13.3	61.6±10.27	57.99±13.34
Age group (years)					
18–45	213 (17.0)	177 (20.4)	111 (16.5)	18 (7.2)	519 (17.0)
46–55	272 (21.7)	258 (29.8)	122 (18.2)	36 (14.4)	688 (22.6)
56–65	363 (28.9)	218 (25.1)	171 (25.4)	99 (39.6)	851 (27.9)
66–75	313 (24.9)	175 (20.2)	182 (27.1)	83 (33.2)	753 (24.7)
≥75	95 (7.6)	39 (4.5)	86 (12.8)	14 (5.6)	234 (7.7)
Gender					
Male	649 (51.7)	454 (52.4)	359 (53.4)	99 (39.6)	1,561 (51.3)
Female	607 (48.3)	413 (47.6)	313 (46.6)	151 (60.4)	1,484 (48.7)
Employment					
Unemployment	1,107 (88.1)	576 (66.4)	567 (84.4)	215 (86.0)	2,465 (81.0)
Employment	124 (9.9)	200 (23.1)	73 (10.9)	28 (11.2)	425 (14.0)
Students and others	25 (2.0)	91 (10.5)	32 (4.8)	7 (2.8)	155 (5.1)
Education level					
Under elementary graduate	648 (51.6)	195 (22.5)	339 (50.4)	108 (43.2)	1,290 (42.4)
Secondary graduate	374 (29.8)	374 (43.1)	199 (29.6)	89 (35.6)	1,036 (34.0)
Above high school graduate	234 (18.6)	298 (34.4)	134 (19.9)	53 (21.2)	719 (23.6)
Marital status					
Single/separated/divorced/widowed	106 (8.4)	146 (16.8)	80 (11.9)	41 (16.4)	373 (12.2)
Living together/married	1,150 (91.6)	721 (83.2)	592 (88.1)	209 (83.6)	2,672 (87.8)
Income level					
≤3,000 CNY/month	968 (77.1)	449 (51.8)	507 (75.4)	188 (75.2)	2,112 (69.4)
>3,000 CNY/month	288 (22.9)	418 (48.2)	165 (24.6)	62 (24.8)	933 (30.6)
Health insurance					
No	9 (0.7)	57 (6.6)	16 (2.4)	3 (1.2)	85 (2.8)
Yes	1,247 (99.3)	810 (93.4)	656 (97.6)	247 (98.8)	2,960 (97.2)
Reasons for HCV antibody testing					
High-risk population passive screening & others	726 (57.8)	604 (69.7)	423 (62.9)	155 (62.0)	1,908 (62.7)
Showed clinical symptoms of hepatitis C	530 (42.2)	263 (30.3)	249 (37.1)	95 (38.0)	1,137 (37.3)
History of HCV risk exposure/behavior					
Having history of unsafe treatment (sharing needles, experience of dental clinic, endoscope examination) or tattoo(s)	617 (49.1)	339 (39.1)	327 (48.7)	41 (16.4)	1,324 (43.5)
Having history of blood transfusion (organ, tissue) or cell transplant (renal) dialysis	250 (19.9)	282 (32.5)	126 (18.8)	34 (13.6)	692 (22.7)
Having history of commercial blood donation	33 (2.6)	7 (0.8)	14 (2.1)	154 (61.6)	208 (6.8)
Having history of intravenous drug abuse, sexual intercourse with sex workers or living with person (s) infected with HBV/HCV	38 (3.0)	96 (11.1)	32 (4.8)	12 (4.8)	178 (5.8)
Mother to child transmission	6 (0.5)	6 (0.7)	2 (0.3)	1 (0.4)	15 (0.5)
Unknown	312 (24.8)	137 (15.8)	171 (25.4)	8 (3.2)	628 (20.6)
Awareness of HCV related knowledge					
No	482 (38.4)	311 (35.9)	331 (49.3)	98 (39.2)	1,222 (40.1)

Continued

Factor	Xuzhou City (*N*=1,256) *n* (%)	Wuxi City (*N*=867) *n* (%)	Yancheng City (*N*=672) *n* (%)	Zhenjiang City (*N*=250) *n* (%)	Total (*N*=3,045) *n* (%)
Yes	774 (61.6)	556 (64.1)	341 (50.7)	152 (60.8)	1,823 (59.9)
Having conducted HCV RNA testing					
No	595 (47.4)	462 (53.3)	289 (43.0)	136 (54.4)	1,482 (48.7)
Yes	661 (52.6)	405 (46.7)	383 (57.0)	114 (45.6)	1563 (51.3)
Treatment regimens					
Unantiviral treatment regimens (others regimens & untreatment)	817 (65.0)	475 (54.8)	457 (68.0)	117 (46.8)	1,866 (61.3)
Asymptomatic	346 (42.4)	162 (34.1)	255 (55.8)	33 (28.2)	796 (26.1)
Unaffordable expenditure	288 (35.3)	200 (42.1)	130 (28.4)	55 (47.0)	673 (22.1)
Undelivered antiviral treatment	59 (7.2)	35 (7.4)	27 (5.9)	9 (7.7)	130 (4.3)
Unawareness of HCV infection status	104 (12.7)	45 (9.5)	36 (7.9)	17 (14.5)	202 (6.6)
Others	20 (2.4)	33 (6.9)	9 (2.0)	3 (2.6)	65 (2.1)
Antiviral treatment regimens (IFN-based antiviral treatment regimen or DAAs-based antiviral treatment regimen)	439 (35.0)	392 (45.2)	215 (32.0)	133 (53.2)	1,179 (38.7)

Abbreviation: CNY=Chinese Yuan; HCV=hepatitis C virus; HBV=hepatitis B virus; RNA=ribonucleic acid; IFN=interferon; DAAs=direct acting antiviral agents.

SUPPLEMENTARY TABLE S2. Univariable and multivariable analysis assessing characteristics associated with receiving antiviral treatment.

Factor	Univariable analysis			Multivariable analysis		
	OR	95% *CI*	*P* value	*OR*	95% *CI*	*P* value
Age group (years)						
18–45		1.00 (Ref)			1.00 (Ref)	
46–55	1.06	(0.84, 1.34)	0.613	1.18	(0.91, 1.52)	0.23
56–65	0.97	(0.78, 1.21)	0.782	1.05	(0.82, 1.35)	0.70
66–75	0.71	(0.56, 0.90)	0.003	0.88	(0.66, 1.16)	0.35
≥75	0.43	(0.31, 0.62)	<0.001	0.60	(0.41, 0.90)	0.01
Gender						
Male		1.00 (Ref)			1.00 (Ref)	
Female	0.75	(0.65, 0.87)	<0.001	0.79	(0.67, 0.93)	0.004
Employment						
Unemployment		1.00 (Ref)				
Employment	1.57	(1.28, 1.94)	<0.001			
Students and others	1.42	(1.02, 1.97)	0.037			
Education level						
Under elementary graduate		1.00 (Ref)			1.00 (Ref)	
Secondary graduate	1.41	(1.19, 1.68)	<0.001	1.06	(0.86, 1.31)	0.574
Above high school graduate	2.07	(1.71, 2.50)	<0.001	1.49	(1.17, 1.89)	0.001
Marital status						
Single/separated/divorced/widowed		1.00 (Ref)				
Living together/married	0.86	(0.69, 1.08)	0.189			
Residence						
Xuzhou City		1.00 (Ref)			1.00 (Ref)	
Wuxi City	1.54	(1.29, 1.83)	<0.001	1.59	(1.31, 1.95)	<0.001

Continued

Factor	Univariable analysis			Multivariable analysis		
	OR	95% *CI*	*P* value	*OR*	95% *CI*	*P* value
Yancheng City	0.88	(0.72, 1.07)	0.191	0.91	(0.73, 1.13)	0.387
Zhenjiang City	2.12	(1.61, 2.78)	<0.001	2.21	(1.51, 3.23)	<0.001
Income level						
≤3.000 CNY/month		1.00 (Ref)				
>3,000 CNY/month	1.59	(1.36, 1.86)	<0.001			
Health insurance						
No		1.00 (Ref)				
Yes	1.1	(0.71, 1.73)	0.666			
Reasons for HCV antibody testing						
High-risk population passive screening & others		1.00 (Ref)			1.00 (Ref)	
Showed clinical symptoms of hepatitis C	1.3	(1.11, 1.49)	0.001	1.5	(1.27, 1.77)	<0.001
Awareness of HCV related knowledge						
No		1.00 (Ref)			1.00 (Ref)	
Yes	1.97	(1.69, 2.29)	<0.001	1.64	(1.39, 1.94)	<0.001
Having conducted testing for HCV RNA						
No		1.00 (Ref)			1.00 (Ref)	
Yes	3.31	(2.83, 3.86)	<0.001	3.48	(2.96, 4.10)	<0.001
Having history of unsafe treatment (sharing needles, experience of dental clinic, endoscope examination) or tattoo(s)						
No		1.00 (Ref)				
Yes	0.958	(0.83, 1.11)	0.566			
Having history of blood transfusion (organ, tissue) or cell transplant (renal) dialysis						
No		1.00 (Ref)			1.00 (Ref)	
Yes	1.566	(1.32, 1.86)	<0.001	1.52	(1.26, 1.84)	<0.001
Having history of commercial blood donation						
No		1.00 (Ref)			1.00 (Ref)	
Yes	1.708	(1.29, 2.27)	<0.001	1.51	(1.10, 2.27)	0.045
Having history of intravenous drug abuse, sexual intercourse with sex workers or living with person (s) infected with HBV/HCV						
No		1.00 (Ref)				
Yes	1.053	(0.77, 1.44)	0.742			
Mother to child transmission						
No		1.00 (Ref)				
Yes	1.387	(0.50, 3.84)	0.528			

Abbreviation: Ref=reference; *OR*=odds ratio; *CI*=confidence interval; CNY=Chinese Yuan; HCV=hepatitis C virus; HBV=hepatitis B virus; RNA=ribonucleic acid.

Vital Surveillances

Temporal and Spatial Trends in HIV Positivity Rate for VCT Clinics — China, 2015–2022

Yi Liu[1]; Rong Su[1]; Dongmin Li[1]; Shaorong Wang[1]; Mengjie Han[1,#]

ABSTRACT

Introduction: Human immunodeficiency virus (HIV) voluntary counseling and testing (VCT) clinics play a critical role in identifying and diagnosing HIV cases. This study aimed to describe the trend of HIV positivity rate (HPR) among Chinese VCT clinics between 2015 and 2022.

Methods: This study utilized data from the China Information System for Disease Control and Prevention to analyze the trend in the HPR for VCT clinics from 2015 to 2022. The HPR was calculated by dividing the number of newly-reported HIV cases by the number of HIV tests, multiplied by 100%. To identify temporal and spatial trends in the HPR, we employed joinpoint regression analysis and the Getis-Ord hotspot analysis.

Results: From 2015 to 2022, VCT clinics in China performed a total of 22,075,386 HIV tests, leading to the identification of 260,353 HIV cases, resulting in a HPR of 1.18%. The HPR consistently declined over the study period, with an average annual percent change (AAPC) of –7.5% (95% confidence interval: –12.6%, –2.2%, P<0.05). The number of HPR hotspots also decreased from 41 in 2015 to 23 in 2022. These HPR hotspots were primarily located in Yunnan, Sichuan, Guangdong, and Guangxi provincial-level administrative divisions (PLADs). Among the 31 PLADs, 16 showed a significant decrease in HPR during the study period (AAPC<0, P_{AAPC}<0.05).

Conclusions: VCT clinics in China have played a significant role in identifying HIV cases. The declining HPR observed in these clinics may indicates the progress has been made in some degree in mitigating HIV among high-risk populations. Therefore, it is crucial to further improving the utilization of VCT clinics for HIV testing.

Human immunodeficiency virus (HIV) voluntary counseling and testing (VCT) is the process in which individuals who suspect they may be at risk for HIV infection voluntarily seek HIV testing and related services through consultation with healthcare professionals. In 2004, China implemented the "four-free-one-care" policy, which included the establishment of VCT clinics. These clinics were set up in collaboration with the CDC and medical institutions (*1*). As of the end of 2020, China has successfully established a network of 11,319 VCT clinics nationwide (*2*). This extensive infrastructure serves as the cornerstone for providing HIV testing and associated behavioral interventions. It is primarily through these VCT clinics that individuals from high-risk populations are able to access essential HIV testing services. Monitoring the HIV cases reported by these VCT clinics can provide valuable insights into the trends in HIV prevalence among high-risk populations (*3*).

This study analyzes the trends in HIV testing and identify cases within VCT clinics in China from 2015 to 2022. The objective is to offer valuable insights concerning the spatial and temporal distribution patterns of the HIV positivity rate (HPR) among VCT clinics in China.

METHODS

Data Sources

Data on HIV testing and reported HIV cases from VCT clinics were obtained from the China Information System for Disease Control and Prevention. The data were collected annually and included the following variables: 1) geographical location of the VCT clinic, 2) number of HIV tests conducted, and 3) number of newly-reported HIV cases. It is important to highlight that the HIV cases included in the analysis met two simultaneous criteria:

they were Chinese cases, and they were reported within the period from January 1, 2015 to December 31, 2022.

Administrative division data were obtained from the National Bureau of Statistics, accessed on September 20, 2023, via the official website (http://www.stats.gov.cn/sj/tjbz/qhdm/). The analytical framework employed spatial units comprising a total of 367 units. These units consisted of 333 municipal-level administrative districts, 4 municipalities directly governed by the central government, and 30 counties under provincial jurisdiction.

Statistical Analysis

The HPR for VCT clinic was calculated using the following formula: $\text{HPR} = \frac{\text{Number of newly reported HIV cases}}{\text{Number of HIV tests}} \times 100\%$. The provincial-level administrative divisions (PLADs) with HPR exceeding the median value in 2015 were categorized as high HPR areas. Conversely, the PLADs below this threshold were labeled as low HPR areas. To examine the temporal trends of HPR from 2015 to 2022, we estimated the annual percent change (APC) and the average annual percent change (AAPC), along with their respective 95% confidence intervals (*CI*), by jointpoint regression. The assessment of spatial correlation in HPR was conducted using the Global Moran's *I* statistic. Under $P<0.05$, positive values of Moran's *I* indicated a positive spatial correlation. The Moran's *I* closer to 1 signified that neighboring spatial units exhibited greater similarity or clustered distribution. The Moran's *I* closer to 0 indicated a random spatial distribution. Getis-Ord (Gi*) hotspot analysis was used to identify hotspots ($Z>1.96$) and cold spots ($Z<-1.96$) of HPR. Statistical analyses were conducted in the R (version 4.1.1; R Core Team and the R Foundation for Statistical Computing, Vienna, Austria), Joinpoint Regression Program (version 4.9.0.1; National Cancer Institute, Bethesda, US), and Geoda (version 1.20.0; University of Chicago, Chicago, US), and all tests were two-tailed with statistical significance at $P<0.05$.

RESULTS

Trends in HIV Positivity Rate for VCT Clinics

Between 2015 and 2022, VCT clinics in China offered a total of 22,075,386 HIV tests, which led to the identification of 260,353 newly-reported HIV cases. These newly-reported cases accounted for 25.0% (260,353/1,043,165) of the total number of HIV cases reported in China during the same period (Table 1). The number of HIV tests showed a consistent increase from 2,397,271 in 2015 to 3,088,305 in 2018, representing a significant rise of 22.3%. However, there was a decline in 2019, with 2,797,414 tests performed in 2022, equivalent to 90.5% (2,797,414/3,088,305) of the 2018 level. Regarding newly-reported HIV cases, there was an upward trend from 33,423 cases in 2015 to 37,407 cases in 2019. However, this trend reversed in 2020, resulting in a decrease in the number of newly-reported cases. In 2022, there were 22,954 cases, accounting for 61.3% (22,954/37,407) of the 2019 count.

Temporal Trends in HPR from 2015 to 2022

Overall, the HPR for VCT clinics was 1.18% (260,353/22,075,386) between 2015 and 2022 (Table 1). During this period, there was a significant decline in the HPR (AAPC=−7.5%, 95% *CI*: −12.6%, −2.2%), dropping from 1.39% in 2015 to 0.82% in 2022, with a reduction of 41.01% (Table 1). The APC of HPR was −3.8% (95% *CI*: −12.4%, 5.6%) from 2015 to 2019. Following this period, the downward trend accelerated from 2020 to 2022 (APC=−12.2%, 95% *CI*: −26.2%, −12.2%).

None of the 31 PLADs demonstrated the trend of increase in the HPR between 2015 and 2022, as shown in Table 2. Based on the median HPR value (1.10%) observed in the 31 PLADs in 2015, 16 PLADs were classified as high HPR PLADs (HPR>1.10%), as depicted in Figure 1. The remaining 15 PLADs were

TABLE 1. HIV positivity rate for VCT clinics in China, 2015–2022.

Year	HIV tests times	HIV cases numbers	HPR (%)
2015	2,397,271	33,423	1.39
2016	2,504,262	36,066	1.44
2017	2,619,692	36,177	1.38
2018	3,088,305	36,419	1.18
2019	2,892,538	37,407	1.29
2020	2,809,969	28,498	1.01
2021	2,965,935	29,409	0.99
2022	2,797,414	22,954	0.82
Total	22,075,386	260,353	1.18

Abbreviation: HIV=human immunodeficiency virus; VCT=voluntary counseling and testing; HPR=HIV positivity rate.

TABLE 2. HIV positivity rate for VCT clinics and average annual percentage change, broken down by PLADs, 2015–2022.

Class	PLADs	HPR (%)		AAPC (%)	95% *CI* (%)	*P* value
		2015	2022			
Total		1.39	0.82	−7.5	(−12.6, −2.2)	0.006
High HPR-decline	Beijing	6.09	2.63	−12.6	(−18.1, −6.7)	<0.001
	Xinjiang	2.08	0.72	−11.0	(−15.5, −6.2)	0.002
	Hainan	2.04	0.86	−10.5	(−18.6, −1.5)	0.023
	Fujian	1.48	0.80	−10.3	(−14.9, −5.5)	0.002
	Yunnan	3.34	1.58	−7.8	(−12.3, −3.1)	0.007
	Henan	1.56	0.95	−7.6	(−10.0, −5.1)	<0.001
	Shanghai	2.50	1.50	−7.5	(−12.8, −1.9)	0.009
High HPR-no decline	Guizhou	1.23	0.58	−7.8	(−17.4, 2.8)	0.144
	Sichuan	2.03	0.93	−7.3	(−19.3, 6.4)	0.227
	Jiangsu	1.18	0.83	−6.9	(−15.4, 2.4)	0.142
	Chongqing	1.58	1.47	−6.8	(−15.0, 2.2)	0.112
	Hunan	1.88	1.03	−6.2	(−12.6, 0.6)	0.065
	Jilin	2.17	1.38	−5.9	(−13.9, 2.7)	0.174
	Guangxi	2.72	1.78	−4.9	(−12.3, 3.1)	0.221
	Guangdong	1.35	1.41	−2.1	(−15.7, 13.9)	0.790
	Tianjin	1.28	0.79	−1.0	(−9.4, 8.2)	0.789
Low HPR-decline	Xizang	0.93	0.16	−25.8	(−38.7, −10.3)	0.009
	Gansu	0.45	0.09	−17.4	(−23.2, −11.2)	0.001
	Liaoning	0.95	0.38	−13.4	(−21.7, −4.2)	0.005
	Inner Mongolia	0.65	0.26	−13.2	(−17.0, −9.2)	<0.001
	Shanxi	0.80	0.34	−11.3	(−15.8, −6.5)	0.001
	Qinghai	0.70	0.28	−10.1	(−16.1, −3.8)	0.009
	Shaanxi	0.76	0.47	−7.7	(−12.5, −2.6)	0.010
	Heilongjiang	0.95	0.56	−7.5	(−10.1, −4.7)	<0.001
	Shandong	0.72	0.48	−4.0	(−7.7, −0.2)	0.042
Low HPR-no decline	Hebei	0.43	0.33	−3.8	(−10.8, 3.7)	0.308
	Hubei	0.88	0.68	−3.8	(−10.3, 3.2)	0.281
	Ningxia	0.21	0.29	−2.8	(−10.9, 6.1)	0.462
	Anhui	0.89	0.73	−2.4	(−10.9, 6.8)	0.592
	Zhejiang	1.04	0.88	−2.1	(−4.8, 0.7)	0.120
	Jiangxi	0.78	0.60	−1.2	(−6.0, 3.8)	0.567

Abbreviation: HIV=human immunodeficiency virus; VCT=voluntary counseling and testing; PLADs=provincial-level administrative divisions; HPR=HIV positivity rate; AAPC=average annual percentage change.

categorized as low HPR PLADs (HPR<1.10%), also illustrated in Figure 1. Among the 16 high HPR PLADs, seven PLADs, namely Beijing, Shanghai, Fujian, and others, exhibited a statistically significant downward trend (AAPC<0, P_{AAPC}<0.05), with Beijing showing the most rapid decline in HPR (AAPC=−12.6%, 95% *CI*: −18.1%, −6.7%). Conversely, nine PLADs including Sichuan, Chongqing, Guangdong, and others, did not display a notable downward trend in HPR (P_{AAPC}>0.05). Of the 15 low HPR PLADs, nine, such as Shanxi, Inner Mongolia, Liaoning, and others, showed a downward trend in HPR (AAPC<0, P_{AAPC}<0.05). Notably, Xizang PLAD experienced the most substantial decline in HPR (AAPC=−25.8%, 95% *CI*: −38.7%, −10.3%). In contrast, six PLADs including Hebei, Jiangxi, Anhui, and others, showed a decrease in HPR, but the changes were not statistically significant (P_{AAPC}>0.05).

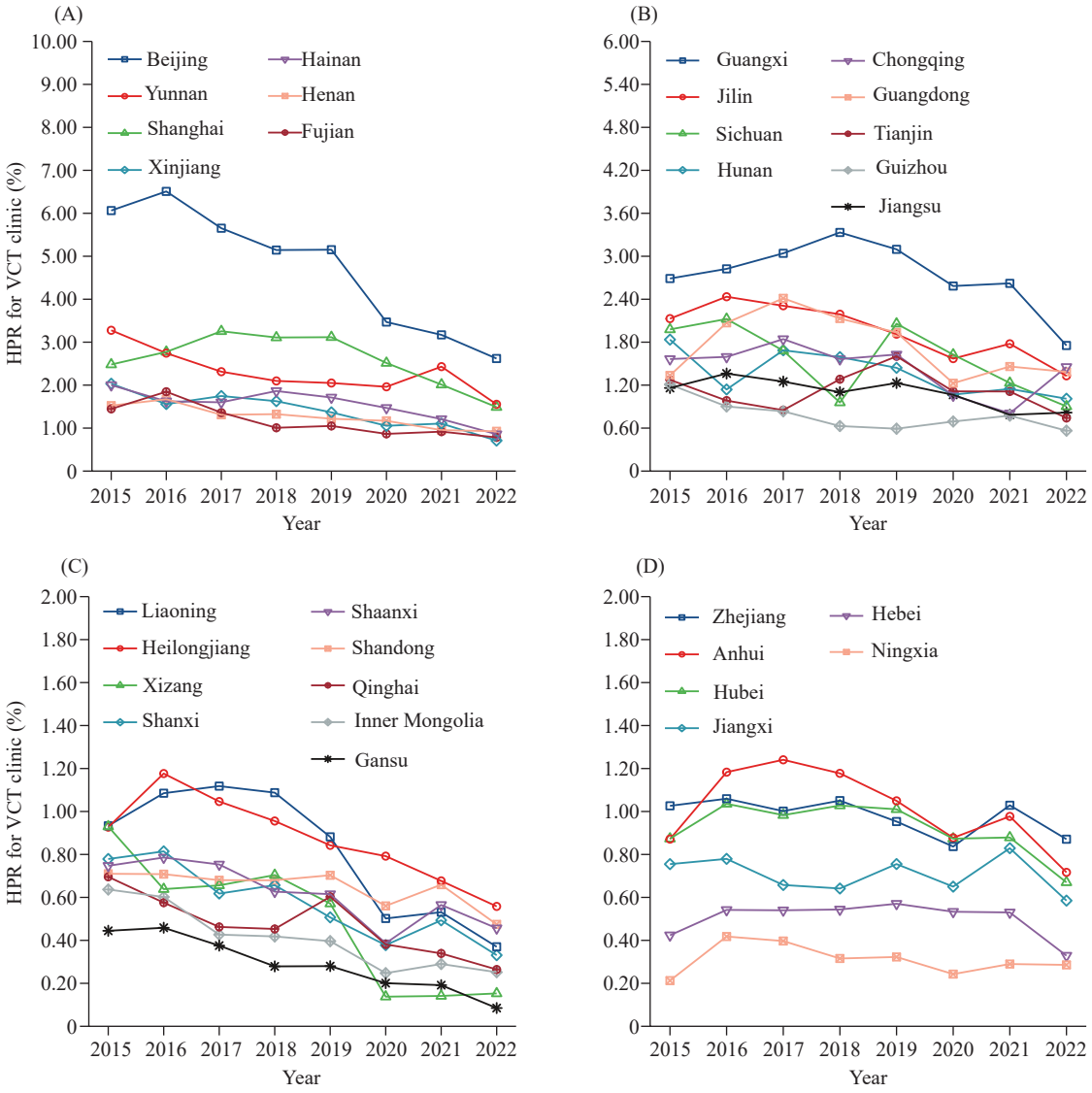

FIGURE 1. Trends in the HPR for VCT clinics from 2015 to 2022, broken down by PLADs. (A) High HPR-decline; (B) High HPR-no decline; (C) Low HPR-decline; and (D) Low HPR-no decline.
Abbreviation: HIV=human immunodeficiency virus; HPR=HIV positivity rate; VCT=voluntary counseling and testing; PLADs=provincial-level administrative divisions.

TABLE 3. The global autocorrelation of HIV positivity rate in 367 units, 2015–2022.

Year	Moran's *I*	*Z* Score	*P* value
2015	0.12	3.46	0.002
2016	0.02	0.84	0.128
2017	0.04	1.72	0.045
2018	0.12	3.86	0.007
2019	0.23	7.22	0.001
2020	0.17	5.30	0.003
2021	0.11	4.49	0.003
2022	0.18	6.20	0.001

Spatial Distribution of HPR

Between 2015 and 2022, the HPR for 367 study units had no spatial autocorrelation (Z=0.84, *P*=0.128) only in 2016 (Table 3). There was a decrease in the number of HPR hotspots over these years, declining from 41 in 2015 to 23 in 2022. In general, these HPR hotspots were predominantly concentrated in Yunnan, Sichuan, Guangdong, and Guangxi PLADs. Between 2015 and 2017, the hotspots predominantly appeared in Yunnan, Sichuan, Guangxi, and Guangdong PLADs. From 2018 onward, hotspot numbers decreased in Yunnan and Sichuan PLADs, whereas Xinjiang PLAD noted an increase. Between 2020 and

2022, the hotspots were mainly concentrated in Guangdong and Xinjiang PLADs. However, the distribution of cold spots remained relatively stable, mainly concentrated in the northern China, including Shanxi, Inner Mongolia, Ningxia, Shaanxi, Gansu, and Qinghai PLADs.

CONCLUSIONS

This study reveals that the number of HIV tests offered by VCT clinics in China exhibited an increase followed by a decrease between 2015 and 2022, while the HPR for VCT clinics exhibited an overall decrease. In 2012, China released the 12th Five-Year Plan for HIV Prevention and Control, which states that China would expand HIV testing, raise public awareness of HIV testing, and promote active testing (*4*). Nevertheless, the growth rate in HIV test numbers for VCT clinics has lagged behind that in medical institutions (*5*). This is mainly because VCT clinics are influenced by the individual initiative of visitors and external factors. Future efforts will likely concentrate on improving the convenience and privacy of VCT services. The number of HIV tests in 2020 and 2022 was significantly lower than in surrounding years, possibly related to the coronavirus disease 2019 (COVID-19) pandemic (*6*).

The present study observed a higher HPR in VCT clinics compared to medical institutions in a previous study (*5*). This discrepancy can primarily be attributed to the fact that VCT clinics primarily serve individuals engaged in high-risk sexual behaviors (*3*). In medical institutions, HIV testing mainly involves mandatory tests associated with surgeries and invasive procedures, and provider-initiated testing and counseling (PITC) services (*5*). It is important to note that the majority of individuals undergoing HIV tests in medical institutions belong to the general population, which typically exhibits a lower likelihood of HIV infection. Consequently, the efficiency of HIV testing in medical institutions is lower. Remarkably, VCT clinics identified 25.0% of all HIV cases, despite VCT testing constituting only 1.2% of the total annual HIV tests conducted in China (*7*). This underscores the critical role that VCT clinics play in identifying HIV cases in the country. Therefore, it is essential for VCT clinics to continue fulfilling this pivotal role, not only in terms of HIV case detection but also in promoting HIV testing awareness through online and offline combination.

Another significant finding is the overall decline in HPR. More than half of the 31 PLADs have shown a decreasing trend in HPR between 2015 and 2022. It may suggest that progress has been made in mitigating HIV epidemic among key populations through the implementation of the 13th Five-Year Plan for HIV prevention and control and the Implementation Program for Controlling the Spread of HIV (2019–2022) (*8*). In recent years, the Chinese government has consistently emphasized the importance of regular HIV testing and testing frequency among high-risk populations. Notable improvements in HIV testing rates have been observed among men who have sex with men (MSM) through referrals for testing by non-governmental organizations and educational outreach on social networking apps (*9*). The decline in HPR since 2020 can, in part, be attributed to the impact of the COVID-19 pandemic (*10*). Research has shown that concerns related to COVID-19 and the non-pharmacological interventions implemented by the government have reduced the likelihood of engaging in high-risk sexual behavior or meeting new sexual partners (*11*). Consequently, this reduction in high-risk behavior may have indirectly contributed to both a lower risk of HIV infection and a decrease in the demand for HIV testing, resulting in the decline in HPR. Moving forward, it is crucial to maintain active HIV surveillance and implement targeted interventions to prevent any resurgence of the HIV epidemic among key populations. PLADs that have not experienced a significant decline in HPR should consider exploring innovative operational approaches, such as integrating passive counseling and testing services with proactive outreach for HIV prevention.

Between 2015 and 2022, the distribution of hotspots and cold spots for HPR in China corresponded to the spatial distribution characteristics of the HIV epidemic (*12*). PLADs such as Sichuan, Yunnan, and Guangxi have been particularly affected by the HIV epidemic in China (*13*). As of 2017, the Chinese government has been implementing comprehensive HIV testing measures that cover the entire population in high HIV prevalence regions located in southwestern China. It is possible that this policy has indirectly resulted in a decrease in the proportion of HIV cases reported by VCT clinics in that area (*14*). Starting in 2018, new hotspots have appeared in Guangdong, Guangxi, and Xinjiang, consistent with previous research findings (*15*). These developments underline the importance of closely monitoring the HIV epidemic in these current hotspots and implementing targeted HIV surveillance

and intervention activities.

This study had several limitations. First, the data on HIV tests for VCT clinics were reported as test counts rather than individual-level data. The characteristics of people receiving HIV testing in VCT clinics may vary in different years. Consequently, the proportion of individuals who undergo repeat testing at VCT clinics each year is unknown. This knowledge gap may result in an underestimation of the HPR. Second, the number of HIV tests conducted and newly-reported HIV cases are influenced by factors such as testing willingness, testing conditions, and accessibility. These factors may not fully capture the true HIV prevalence within key populations. Thus, the data may be subject to bias and may not provide a comprehensive depiction of the actual situation.ta may be subject to bias and may not provide a comprehensive depiction of the actual situation.

In conclusion, VCT clinics in China have played a significant role in detecting HIV cases. The decreasing HPR observed in these clinics may suggests that China has made notable strides in curbing HIV prevalence among high-risk populations. It is crucial to further improve the utilization of VCT clinics for the identification of HIV cases. Moving forward, it is vital to explore novel models for VCT services, such as integrating passive testing with proactive outreach services, to enhance their effectiveness.

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REFERENCES

1. Wu ZY, Chen JF, Scott SR, McGoogan JM. History of the HIV Epidemic in China. Curr HIV/AIDS Rep 2019;16(6):458 – 66. http://dx.doi.org/10.1007/s11904-019-00471-4.
2. Han MJ, Chen QF, Xu P, Shi Y. Forging ahead in the thirteenth five-year plan: a review and prospects of HIV/AIDS prevention and control in China. Chin J AIDS STD 2021;27(12):1327 – 31. http://dx.doi.org/10.13419/j.cnki.aids.2021.12.01. (In Chinese).
3. Costa AB, Viscardi LH, Feijo M, Fontanari AMV. HIV Voluntary Counseling and Testing (VCT-HIV) effectiveness for sexual risk-reduction among key populations: a systematic review and meta-analysis. eClinicalMedicine 2022;52:101612. http://dx.doi.org/10.1016/j.eclinm.2022.101612.
4. The State Council of the People's Republic of China. Chinese 12th Five-Year Plan for HIV/AIDS Prevention and Control. https://www.gov.cn/gongbao/content/2012/content_2084242.htm. [2023-9-20]. (In Chinese).
5. Wang HX, Xu J, Zang CP. HIV/AIDS cases detection in medical institutions from 2016 to 2021 in China. Chin J AIDS STD 2023;29(2):157 – 60. http://dx.doi.org/10.13419/j.cnki.aids.2023.02.07. (In Chinese).
6. Zhao TM, Liu HX, Bulloch G, Jiang Z, Cao ZB, Wu ZY. The influence of the COVID-19 pandemic on identifying HIV/AIDS cases in China: an interrupted time series study. Lancet Reg Health West Pac 2023;36:100755. http://dx.doi.org/10.1016/j.lanwpc.2023.100755.
7. He N. Research progress in the epidemiology of HIV/AIDS in China. China CDC Wkly 2021;3(48):1022 – 30. http://dx.doi.org/10.46234/ccdcw2021.249.
8. The National Disease Prevention and Control Bureau. New advances of HIV/AIDS prevention and control efforts in 2019. Chin J AIDS STD 2019;25(12):1205. http://dx.doi.org/10.13419/j.cnki.aids.2019.12.01. (In Chinese).
9. Sun XD, Xiao YN, Peng ZH, Wang N. Frequent implementation of interventions may increase HIV infections among MSM in China. Sci Rep 2018;8(1):451. http://dx.doi.org/10.1038/s41598-017-18743-7.
10. Wu XS, Wu GH, Ma YM, Huang XJ, Yang YC, Cai YS, et al. The impact of COVID-19 non-pharmaceutical interventions on HIV care continuum in China: an interrupted time series analysis. Lancet Reg Health West Pac 2022;29:100569. http://dx.doi.org/10.1016/j.lanwpc.2022.100569.
11. Gleason N, Banik S, Braverman J, Coleman E. The impact of the COVID-19 pandemic on sexual behaviors: findings from a national survey in the United States. J Sex Med 2021;18(11):1851 – 62. http://dx.doi.org/10.1016/j.jsxm.2021.08.008.
12. Huang JF, Wu HC, Lin S, Lu LL, Zheng JL, Liu B, et al. Spatial-temporal analysis of HIV/AIDS and syphilis in mainland China from 2007 to 2017. J Med Virol 2022;94(7):3328 – 37. http://dx.doi.org/10.1002/jmv.27725.
13. Wang YL, Qin QQ, Ding ZW, Cai C, Guo W, Li DM, et al. Current situation of AIDS epidemic in China. Chin J AIDS STD 2017;23(4):330 – 3. http://dx.doi.org/10.13419/j.cnki.aids.2017.04.16. (In Chinese).
14. Liu ZF, Tang XF, Liu YF, Zhang LL, Yang YH, Zheng YL, et al. HIV prevention and health poverty alleviation — Liangshan prefecture, Sichuan province, China, 2017-2020. China CDC Wkly 2021;3(48):1031 – 5. http://dx.doi.org/10.46234/ccdcw2021.250.
15. Jing FS, Ye Y, Zhou Y, Zhou HC, Xu ZZ, Lu Y, et al. Modelling the geographical spread of HIV among MSM in Guangdong, China: a metapopulation model considering the impact of pre-exposure prophylaxis. Philos Trans Roy Soc A Math Phys Eng Sci 2022;380(2214):20210126. http://dx.doi.org/10.1098/rsta.2021.0126.

Review

Evolution of HIV/AIDS Prevention and Control Policies in China: A Grounded Theory Approach

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ABSTRACT

Objective: This study aims to provide a theoretical foundation for the development and practical application of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) prevention and control policy systems in China by scrutinizing, analyzing, and synthesizing the evolution of Chinese policies in this domain.

Methods: Utilizing grounded theory, we employed NVivo12 software to perform text content analysis, mining, and coding classification, along with visualization techniques, on policy texts sourced from Chinese government platforms, including the official website of China's State Council. We considered four analytical dimensions — time, subject, type, and object.

Results: The National Health Commission and the State Council emerged as the primary entities engaged in policymaking for HIV/AIDS in China. We identified four distinct stages in the evolution of these policies, culminating in a novel 'sun-shaped' HIV/AIDS prevention and control policy network model with an emphasis on 'knowledge, attitude, and practice' at its nucleus, which aligns with national conditions and societal progress. Furthermore, the focal groups of these policies have been dynamically refined and updated over time.

Conclusions: Our findings introduce a 'sun-shaped' HIV/AIDS prevention and control policy network model specific to China. We observed a conceptual policy shift towards prioritizing overall human health rather than confining the focus to disease treatment. Additionally, in light of China's growing elderly population, the imperative to address HIV/AIDS prevention and control among older adults is an issue that warrants increased attention.

INTRODUCTION

Acquired immunodeficiency syndrome (AIDS), which is caused by the human immunodeficiency virus (HIV), represents a significant threat to both global public health and societal progress, as this infectious disease imperils the well-being and development of human populations (*1–3*). In China, the HIV/AIDS epidemic remains a critical concern, with the burden of prevention and control presenting a substantial and ongoing challenge (*4*). While policy and regulation serve as crucial tools for governmental and administrative bodies tasked with managing AIDS, the literature has not adequately provided a systematic analysis of China's national HIV/AIDS prevention and control policies across various stages of their implementation.

Prior research has tended to concentrate on aspects such as epidemiology, antiviral strategies, sentinel surveillance, key demographics, and legal frameworks. Studies that address HIV/AIDS policy frequently employ a traditional chronological analysis, which often suffers from issues of timeliness and scope. Consequently, a deeper investigation into the underlying patterns and logical progression of policy evolution in the context of HIV/AIDS prevention and control is warranted.

A comprehensive review and analysis of the development of HIV/AIDS prevention and control policies in China over the last four decades would not only facilitate a retrospective assessment of policy efficacy but also assess the scientific rigor and practicality of their implementation. Such an analysis could provide an invaluable foundation for the ongoing advancement and sustainability of HIV/AIDS prevention and control strategies at both the national and regional levels.

METHOD AND DATA

Data Sources and Collection

The dataset for this study was acquired from a comprehensive review of China's State Council's policy document archive, PKULAW.com (an aggregator of Chinese legal statutes, regulatory measures, and policy

records), the repositories of Chinese political journals, and other authorized governmental portals. This review spanned materials from 1984 to 2022 and focused on records embedded with keywords pertinent to AIDS and HIV. A meticulous secondary filtration process was undertaken to align with the research objectives, scrutinizing the relevance, context, and applicability of the documents. Our inclusion criteria were delineated as follows: 1) issuing entities: preeminent departments within the China State Council and their directly subordinate agencies; 2) policy classifications: encompassing a spectrum from laws and regulations to advisory opinions, procedural guidelines, standards, notifications, resolutions, strategic blueprints, and synopses; 3) thematic relevance: policy narratives intrinsically connected to HIV/AIDS discourse.

Conversely, our exclusion criteria eliminated: 1) redundant iterations of policy documents; 2) records elicited by keyword searches yet devoid of substantial linkage to HIV/AIDS thematic elements; 3) ancillary documents including, but not limited to, journalistic coverage of policies, event-based orations, administrative reports, exegeses of policy frameworks, procedural advisories, staffing rosters, and commendatory citations.

Policy Analysis Method

Grounded theory is a qualitative research methodology that employs a bottom-up, empirical data-driven approach, offering systematic protocols for the collection, comparison, induction, synthesis, analysis, and conceptualization of qualitative data to formulate theories (*5*). This study utilized NVivo12 software (Release 1.2, QSR International, Massachusetts of USA) in conjunction with grounded theory to perform word frequency analysis, co-word cluster analysis, text content mining, coding categorization, and visual analysis of the policy text. Furthermore, this combination facilitated the construction of a policy network model and elucidated the evolutionary trajectory of HIV/AIDS prevention and control policies in China.

RESULTS

HIV/AIDS Prevention and Control Policy Network Model

Initially, the textual data was segmented into discrete units, and one hundred open codes were generated to categorize these elements. Subsequently, cluster analysis was performed on these open codes to derive forty-six axial codes, which facilitated a detailed examination of the features and relationships between the principal categories. Ultimately, four core codes — namely "knowledge-attitude-practice (KAP)," "support," "guarantee," and "guidance" — were identified and synthesized (Table 1 and Figure 1). This process culminated in the development of a solar-inspired model of the HIV/AIDS prevention and control policy network (Figure 2).

Time Distribution of Policy Issuance

Beginning with the 1984 Joint Notice on Restricting the Import of Blood Products to Prevent the Spread of HIV/AIDS in China, issued by China's General Administration of Customs, the former Ministry of

TABLE 1. The selective codes of HIV/AIDS prevention and control policies in China.

Core category	Main category	Key concept	Number of references
KAP	Publicity and education Target population Behavioral intervention Team building and personal training	Make relevant knowledge about HIV/AIDS prevention and control understandable to the public so that they can develop positive and correct prevention and control beliefs, attitudes, and behavioral habits that are conducive to HIV/AIDS prevention and control.	1,760
Support	Care and assistance Treatment and services Coordinating mechanism Legal means	Based on the soft means of humanistic care and medical services and the hard means of legal protection against illegal and criminal activities, all government departments and social organizations work together to directly promote the successful implementation of AIDS prevention and control.	626
Guarantee	Monitoring and detection Supervision Evaluation and assessment Funding and subsidies Nosocomial infection and protection	HIV/AIDS prevention and control also includes the attention of the government, the clear division of labor among functional departments, the enhancement of technical level, and the improvement of the supervision and assessment mechanisms and so on, which can indirectly affect the efficiency and quality of AIDS prevention and control work.	698
Guidance	Consolidated guidelines	These are systematic policy texts that contain two or three types of content from the other three core categories an overall guiding meaning.	82

Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; KAP=knowledge-attitude-practice.

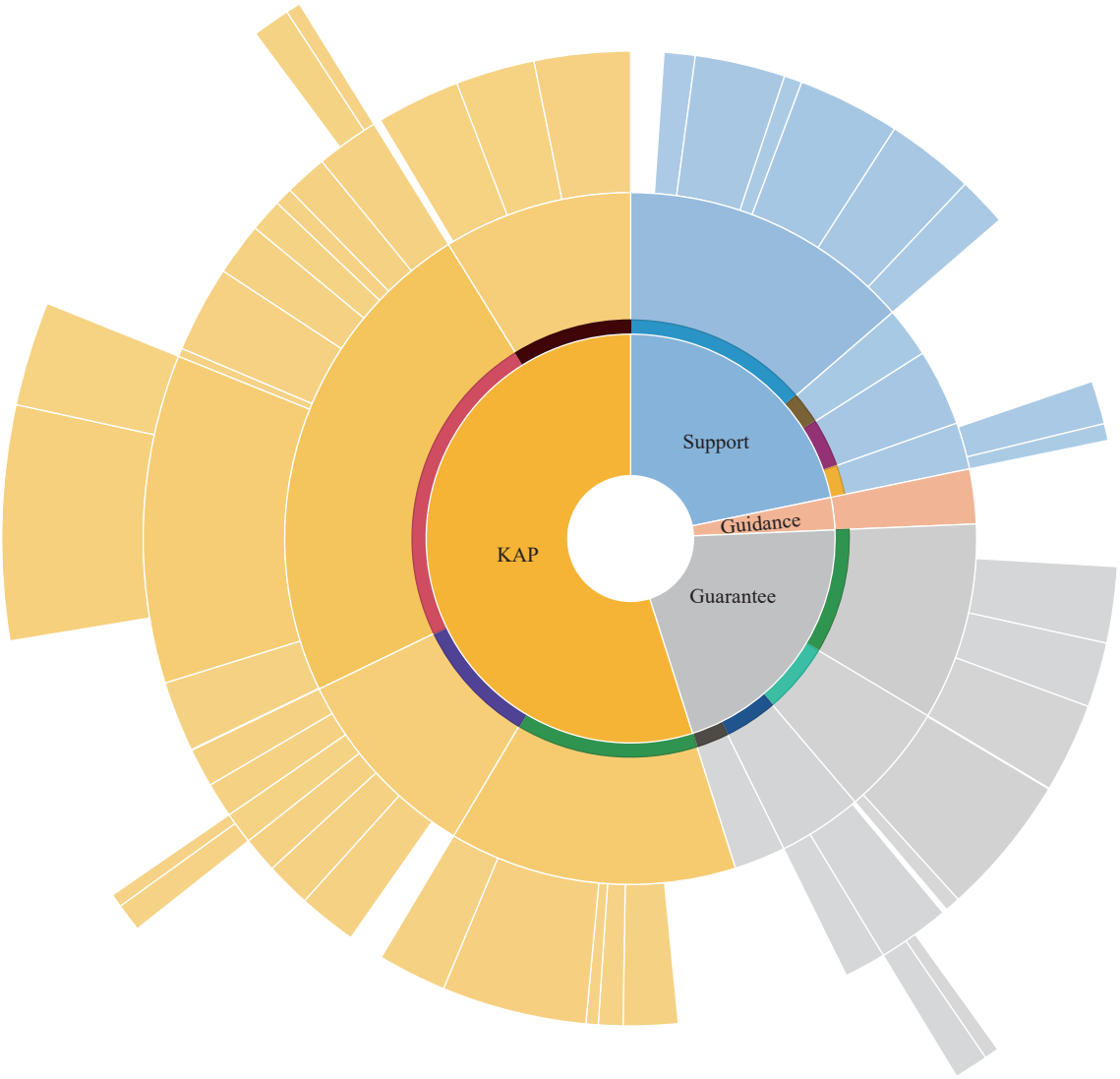

FIGURE 1. Selective codes of HIV/AIDS prevention and control policies in China.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; KAP=knowledge-attitude-practice.

Health, and the Ministry of Foreign Trade and Economic Cooperation, our research traced the trajectory of national policy texts. We observed an initial increase in the number of these documents over the years, followed by a subsequent decline. Upon review, a total of 192 national-level policy texts pertaining to HIV/AIDS prevention and control have been issued to date. The zenith of policy issuance occurred in 2004, with a total of 29 texts (representing 15.10% of the sample), followed by a secondary peak in 2006 with 19 texts (9.90%). Since then, the issuance of related policies has remained relatively stable (Figure 3).

The evolution, distribution, and conceptual transformation of HIV/AIDS prevention and control policies in China, when analyzed in conjunction with the findings of previous scholars (*6*–*9*), suggest that the development of these policies can be segmented into four distinct phases: (*1*) intense monitoring to prevent the introduction of HIV/AIDS (1984–1988), (*2*) enhanced public awareness and proactive prevention measures (1989–1998), (*3*) a government-led, comprehensive approach to prevention and control (1999–2005), (*4*) the adoption and reinforcement of scientifically-informed prevention strategies (since 2006). Reflecting upon these stages, changes in the frequency of keywords associated with HIV/AIDS prevention and control policies are presented in Table 2. For clarity, Table 2 lists only the top ten keywords for each phase, excluding common stop-

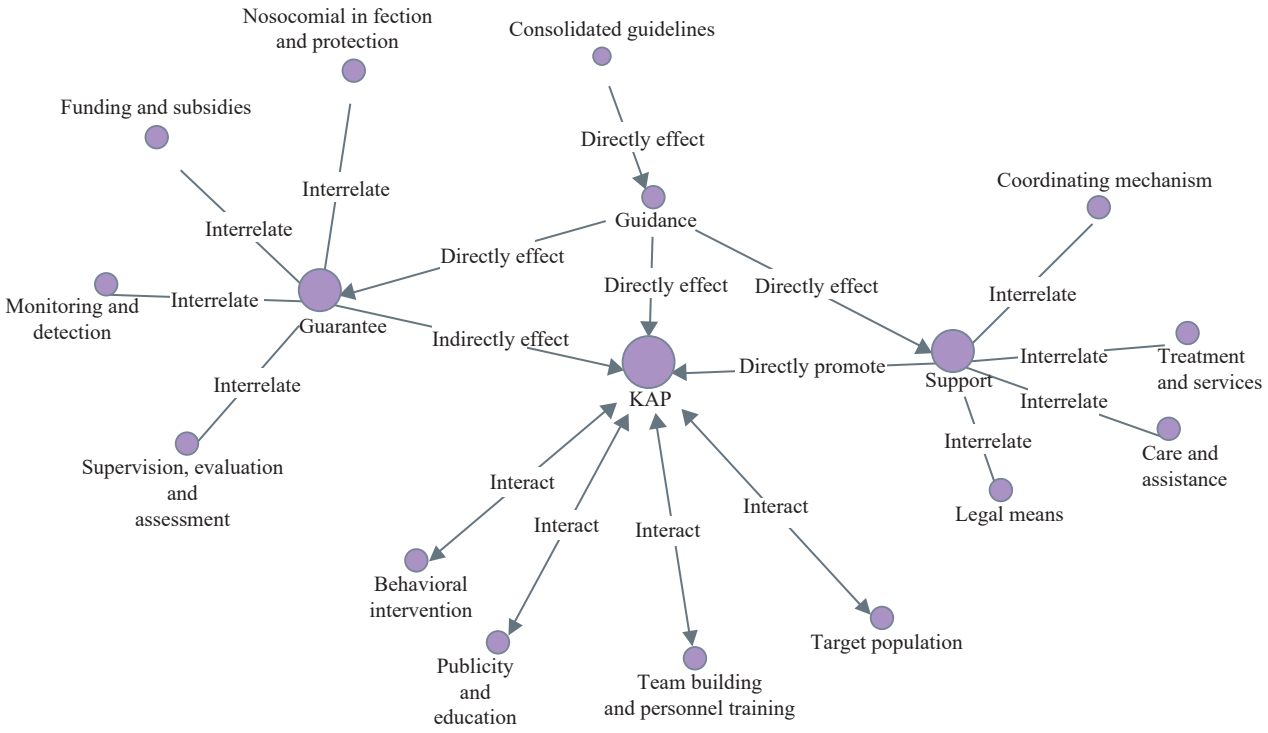

FIGURE 2. Sun-shaped HIV/AIDS prevention and control policy network model in China.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; KAP=knowledge-attitude-practice.

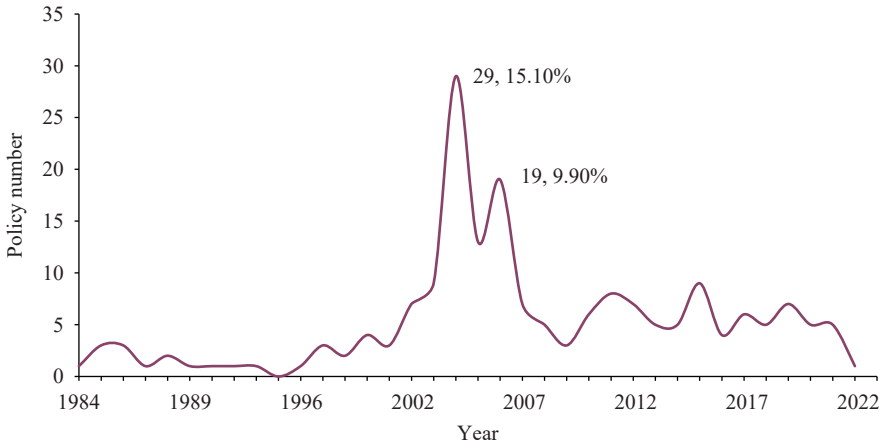

FIGURE 3. Distribution of HIV/AIDS prevention and control policies in China, 1984 to 2022.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.

words as filtered by NVivo12 software, as well as terms lacking substantive relevance, such as possessive pronouns (e.g., yours, mine, his).

Distribution and Development of Policy Subjects

To delineate the evolution of the HIV/AIDS prevention and control policy landscape, our research team conducted a statistical analysis of the departments responsible for issuing policy documents, adjusting for any obfuscations due to renamings, mergers, or dissolutions of the issuing bodies. Utilizing specified inclusion and exclusion criteria, we identified 163 national-level policy documents on HIV/AIDS prevention and control. Among these, 39 (approximately 23.93%) documents were collaboratively issued by multiple government departments in China.

The former Ministry of Health of China (66,

TABLE 2. The high-frequency words change of HIV/AIDS prevention and control policies in China.

Words stages	1984–1988	1989–1998	1999–2005	since 2006
1	HIV/AIDS*	HIV/AIDS*	HIV/AIDS*	HIV/AIDS*
2	Monitor	Quarantine	Prevention	Prevention and treatment
3	Blood	Prevention	Prevention and treatment	Testing
4	Inspection	Publicity	Education	Prevention
5	Import	Testing	Testing	Treatment
6	Sexually transmitted disease	Education	Publicity	Education
7	Management	Sexually transmitted disease	Control	Publicity
8	Prevention	Prevention and treatment	Treatment	Service
9	Dissemination	Monitor	Management	Dissemination
10	Education	Dissemination	Dissemination	Health

Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; KAP=knowledge-attitude-practice.
* Because of Chinese vocabulary usage habits, AIDS and HIV were combined into HIV/AIDS, as the same reason, Prevention and treatment was viewed as a word.

40.49%), the China's State Council (25, 15.34%), the China's Ministry of Education (20, 12.27%), the China's Ministry of Finance (15, 9.20%), and the China's National Health and Family Planning Commission (10, 6.13%). The departments that jointly issued policies include the former Ministry of Health of China (16 times), the China's Ministry of Finance (13 times), the China's Ministry of Education (10 times), the China's State Taxation Administration (8 times), the China's National Health and Family Planning Commission (5 times), the China's Ministry of Justice (4 times), the China's Ministry of Civil Affairs (4 times) and the China's Ministry of Public Security (4 times), etc. The China's State Council, the constituent ministries and commissions of the China's State Council and the organizations directly under the China's State Council had issued policies with a wide time span and the largest proportion; the China's Supreme People's Procuratorate and the united social groups gradually issued policy texts on HIV/AIDS prevention and control after 2006 (Figure 4).

Distribution and Development of Policy Types

Table 3 displays the results of the analysis of policy types across different time periods. In the initial phase, guaranteed policies constituted the largest proportion at 41.46%, followed by KAP policies at 31.71%. Subsequent phases saw supportive policies gaining ground and eventually surpassing guaranteed policies in both the second and third stages. KAP policies maintained a significant presence from the second stage onward. Interestingly, in the fourth stage, guaranteed policies experienced a resurgence, accounting for 30.82% and exceeding supportive policies, which comprised 22.51%.

Distribution and Development of Policy Objects

The categorization of population-related terms from the policy documents was systematically conducted, initially identifying 31 open codes, then consolidating into 11 axial codes, and ultimately crystallizing into 9 selective codes. These definitive codes formed the framework for delineating policy target populations within this study (Figure 5). We statistically assessed the frequency at which these policy target populations appeared at each phase, yielding insights into their prominence and implications. In the initial phase, commercial sex workers and their clients (44.06%), along with transnational travelers and border control personnel (54.11%), were identified as the primary focus groups. During the subsequent phase, the emphasis shifted to children and adolescents (20.04%) and remained on transnational travelers and border control personnel (72.57%). However, there appeared to be a need for heightened vigilance concerning the mobile and migrant populations, individuals of childbearing age, and older adults in forthcoming analyses. The third phase honed in on female adults (47.70%) and children and adolescents (21.12%), ensuring comprehensive population coverage. Currently, the spotlight is shared among children and adolescents (44.22%), female adults (27.18%), and the mobile and migrant population (9.86%).

CONCLUSION AND DISCUSSION

Our research introduces a sun-shaped network

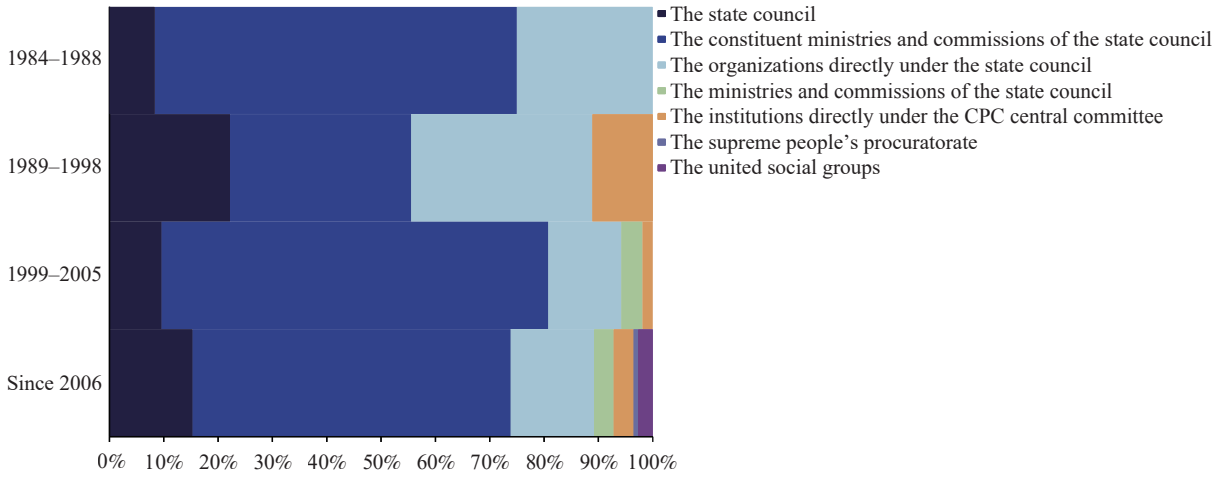

FIGURE 4. Distribution of China's HIV/AIDS prevention and control policy subjects at the national level in different time. Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; CPC=communist party of China.

TABLE 3. Distribution of HIV/AIDS prevention and control policy types in China.

Year	Type, %			
	Guaranteed policies	Support policies	KAP policies	Guiding policies
1984–1988	41.46	24.39	31.71	2.44
1989–1998	19.15	20.21	57.45	3.19
1999–2005	24.93	32.10	38.46	4.51
Since 2006	30.82	22.51	40.77	6.00

Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.

model that offers a nuanced analysis of China's HIV/AIDS prevention and control policies. The paramount goal of these policies is to safeguard public health. Effective prevention and control can only be achieved when the public not only possesses accurate knowledge but also embraces a robust sense of responsibility, allowing beliefs to take shape. It is the transition from mere knowledge to deeply held belief that underpins the public's willingness to adopt positive behavioral changes.

The KAP approach is of particular significance, as it equips individuals with the necessary understanding of HIV/AIDS prevention and control measures. It also fosters constructive beliefs and attitudes toward these measures, culminating in the adoption of healthy behaviors that enhance overall well-being. Given its direct influence on health behaviors and its distinctive nature compared to other policy types, the KAP approach constitutes the core of our proposed model.

Supporting and guaranteeing policies serve to bolster the KAP approach, with the former providing direct reinforcement and the latter having an indirect impact on its implementation and outcomes. Furthermore, the guiding policies exert a direct influence on the other three policy categories, shaping their overall direction and effectiveness.

The NVivo12 software identified high-frequency terms that are fundamentally aligned with policy categories synthesized by grounded theory throughout the evolution of HIV/AIDS prevention and control policies. In the initial stage, terms such as "monitor," "blood," and "import" likely represent stringent measures implemented in China to regulate imported blood products, aiming to thwart the proliferation of HIV/AIDS. This phase saw a predominance of policies focused on safeguards (encompassing core themes such as monitoring, detection, and supervision), reflecting their central role in the policy landscape at the time. In the subsequent phase, words like "quarantine," "prevention," "publicity," "testing," and "education" suggest a shift in response to the widespread nature of the epidemic. With blood transmission, sexual contact, and intravenous drug use emerging as the primary transmission routes, the expansion of testing and quarantine efforts was evident. There was a notable shift towards proactive prevention strategies during this

FIGURE 5. Distribution of HIV/AIDS prevention and control policy objects in China.
Abbreviation: HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome.

time, intensifying education and public awareness campaigns. This emphasis is mirrored in the KAP policies, which were the predominant policy category in this era. The third stage saw "prevention" and "education" maintaining high frequency, with "prevention and treatment" gaining prominence. Notably, the term "control" surged from the eighth to the second position. This change in frequency might relate to the rapid surge in HIV/AIDS cases during this period and the influence of the 2003 SARS outbreak. It reflected the Chinese government's heightened recognition of the critical need to preemptively handle public health crises, with a concerted effort to prevent and manage HIV/AIDS encompassing various facets. KAP, support, and safeguard policies were more evenly distributed, indicating a broader and more integrated policy approach. In the final stage analyzed, the emergence of "service" and "health" among the top ten high-frequency terms suggests an evolution towards scientifically grounded HIV/AIDS prevention and control strategies, with an emphasis on advisory services and overall population health. The prominence of the term "health" might signify the incorporation of Health-first and Health in All Policies (HiAP) concepts in HIV/AIDS policy development. Throughout this period, KAP continued to occupy the largest share of policies, underscoring their importance in boosting health literacy and endorsing healthy living standards.

The development and transformation of HIV/AIDS prevention and control policies in China have shown alignment with practical applications, temporal relevance, and adherence to the policy directives issued by General Secretary Xi Jinping, emphasizing the shift from disease-centric treatment to a broader focus on public health. To a noteworthy degree, the persistence, modification, and cessation of HIV/AIDS prevention and control measures in China have been influenced by the trajectory of societal advancement. However, they are predominantly dictated by the tangible demands and exigencies of HIV/AIDS prevention and control efforts.

Stage I: Strictly Monitor and Prevent Introduction of HIV/AIDS (1984–1988)

During this period, there was a widespread perception that the contemporary, liberal lifestyle of the West was frequently linked with the proliferation

of HIV/AIDS, prompting calls for measures to prevent the introduction of the disease into China. As China's trade in imports and exports flourished, and as interactions with foreign nationals, cutting-edge technologies, and the intermingling of Chinese and Western cultures increased (particularly during the initial and exploratory phase of the economic reform and opening-up from 1978 to 1991), these factors may have contributed to the aforementioned belief. At that time, societal focus was predominantly on economic policy matters, resulting in HIV/AIDS prevention and control strategies that centered on rejecting or halting the importation of foreign blood products. For example, the *Joint Notice on Restricting the Import of Blood Products to Prevent the Spread of HIV/AIDS into China* in 1984. This was followed by the 1985 Prohibition on the importation of blood products, such as Factor VIII, which barred the entry of foreign blood products into the country. By 1986, HIV/AIDS was classified as a Class B infectious disease, with new infections required to be reported within 24 hours.

Stage II: Strengthen Publicity, Education and Active Prevention and Control of HIV/AIDS (1989–1998)

During this period, the policy framework for HIV/AIDS prevention and control underwent significant changes. In 1989, HIV/AIDS was classified as a Class B infectious disease in accordance with the Law of the People's Republic of China on Prevention and Treatment of Infectious Diseases, mandating that HIV/AIDS patients receive isolated treatment. This marked the elevation of HIV/AIDS prevention and control efforts to a legal standing. That same year, the first domestically transmitted case of HIV/AIDS was documented in China. Furthermore, the clustering of HIV/AIDS cases among injection drug users was identified in Ruili, Yunnan Province (*10*). In response to the escalating HIV/AIDS epidemic, the Chinese government intensified law enforcement and initiated a series of punitive actions targeting drug abuse and prostitution beginning in 1991. By 1995, the spread of HIV/AIDS, fueled by illicit and unregulated blood collection and supply activities in Henan, Hubei, Anhui, and other provinces, had become a serious concern (*11*). It was becoming clear that HIV/AIDS was spreading not only through international sources but also internally within the mainland. Evidently, the existing HIV/AIDS prevention and control policies, which were centered on surveillance, were not sufficiently effective. Acknowledging the gravity of the HIV/AIDS epidemic and the critical need for efficacious policy interventions, the Chinese central government implemented a spectrum of policy measures. The Blood Donation Law, enacted in 1998, emphasized voluntary over compensated blood donations to ensure the safety of blood for clinical use and the welfare of both donors and recipients. Additionally, the China National Medium and Long-Term Plan for HIV/AIDS Prevention and Control (1998–2010) promoted condom use to prevent the sexual transmission of HIV/AIDS. Concurrent with the ongoing reforms and the opening-up policy, public attitudes became increasingly receptive to Western ideas, fostering a blend of Chinese and Western cultural elements. There was a noticeable enhancement in public understanding of HIV/AIDS, leading to a shift toward active and preventative approaches in the prevention and control policies, which in turn facilitated more progressive and open prevention and control initiatives.

Stage III: Government-led and Comprehensive Prevention and Control of HIV/AIDS (1999–2005)

The HIV/AIDS epidemic transitioned into a more expansive phase in China following Stage II, with cases reported across diverse populations. As such, singular population-focused prevention and control policies proved insufficient. Demonstrating strong political will and responsibility, the Chinese government implemented a series of comprehensive HIV/AIDS policies. For example, *Working duty in HIV/AIDS prevention and control for related ministries, committees, administrations and social groups* released in 2000 was the first time to explicitly raise the issue of medical security for people infected with HIV/AIDS. The *China's action plan for reducing and preventing the spread of HIV/AIDS (2001–2005)* launched the first Five-Year Action Plan which had considered harm-reduction measures such as methadone maintenance treatment (MMT), needle and syringe exchange and promotion of condom use. In 2003, the progressive "*Four Free and One Care*" policy was introduced in selected areas, offering free antiretroviral drugs to people living with HIV/AIDS. This initiative was instrumental in curbing the epidemic's spread and reducing patient mortality. The period's social security advancements, emerging from the establishment of the socialist market economy (1992–2002), provided a

solid foundation for the era's policymaking. The severe acute respiratory syndrome (SARS) outbreak in 2003 was a pivotal event for Chinese public health governance. This crisis underscored the efficacy of a government-led approach, embracing extensive community participation and multisectoral collaboration as the optimal strategy for resolving public health challenges. Consequently, an approach designed to foster widespread awareness and active engagement in HIV/AIDS prevention and control became progressively formulated and effectively executed. Over time, the nature of prevention and control efforts evolved towards proactive prevention, intervention, and legitimization. Significantly, official pilot programs for HIV/AIDS prevention and control demonstration zones targeting high-risk groups commenced, marking a notable advancement in the nation's response to the HIV/AIDS epidemic.

Stage IV: Enhancing the Implementation of Evidence-Based HIV/AIDS Prevention and Control Strategies (Since 2006)

During the era of socialist market economic development from 2003 to 2011, China experienced a continued strengthening of its economic prowess and an enhancement of its social security system. The government underwent a paradigm shift, opting to procure social services, and acknowledged the necessity of engaging all societal sectors, including non-governmental organizations (NGOs), to achieve mutual benefits in the realm of HIV/AIDS prevention and control. Furthermore, the Chinese government recognized the significant societal impact of HIV/AIDS and placed an elevated emphasis on the health of its citizens. This marked a new phase where government-led initiatives encouraged full public participation and saw the implementation of large-scale, targeted HIV/AIDS prevention and control policies. These policies became more comprehensive, structured, and compassionate. In 2006, the *Regulations on AIDS Prevention and Treatment* were enacted by the State Council of China, formalizing the "*Four Free and One Care*" policy. This policy not only protected the legal rights of individuals living with HIV and their families but also fortified important HIV/AIDS prevention and control efforts through legal and regulatory measures. It sanctioned behavioral interventions like condom promotion and substitution therapy for drug users, and it established a firm stance against discrimination. This regulation also provided a formal legislative endorsement for the provision of free antiretroviral treatment for individuals with HIV/AIDS. Wu Zunyou, the lead expert in epidemiology from the Chinese Center for Disease Control and Prevention, remarked that the "*Four Free and One Care*" policy was a cornerstone for HIV/AIDS prevention and control efforts in China. It not only reinforced these efforts, but it also indicated a significant shift in the government's approach — from denial and inaction to proactive involvement and advocacy, setting an example at the global level (*12*). Proceeding with the proactive stance on HIV/AIDS countermeasures, the "*China's Action Plan on HIV/AIDS Prevention and Containment (2006–2010)*" unrolled the second Five-Year Action Plan. This initiative built upon existing efforts by developing more targeted strategies and objectives. In 2008, the Ministry of Health released a directive to pilot an integrated HIV prevention and treatment program specifically for men who have sex with men, representing the most comprehensive policy to date addressing China's HIV epidemic among this demographic address the HIV/AIDS epidemic among men in China. The policy named *Five Expands and Six Strengths* were proposed in 2010 to address the problems encountered by the *Four Free and One Care* policy, particularly in health education, HIV testing, and prevention and care services, ensuring a multifaceted approach to the ongoing health crisis.

In the context of comprehensive reform initiatives commenced in 2012, the Chinese government has implemented a robust reform agenda epitomized by an integrative five-sphere plan encompassing economic, political, cultural, social, and environmental domains. The government remains committed to sustaining and enhancing public welfare, bolstering prevention and control authorities, increasing funding, and refining supervision and evaluation mechanisms. Notably, China's 12th *Five-Year Action Plan for reducing and preventing the spread of HIV/AIDS (2011–2015)* clarified the concept and measuring method of new infections of HIV/AIDS, expanding the coverage of HIV testing and surveillance, and maximizing the detection of HIV/AIDS cases. It also first proposed the principle of *Knowing Situation but Not Refusing* — When HIV testing agencies explicitly informed citizens that they would be provided with HIV testing services, the citizen who did not refuse was deemed to agree to undergo testing. Similarly, the 13th *Five-Year Action Plan for HIV/AIDS control (2016–2020)* aimed to raise awareness of HIV/AIDS prevention and treatment

among the populace, extend the reach of testing and surveillance activities, and ensure comprehensive follow-up and execution of treatment and rescue measures. Furthermore, the *Action Plan to Eliminate Mother-to-Child Transmission of HIV/AIDS, Syphilis, and Hepatitis B (2022–2025)* sets objectives for the strengthened prevention of vertical transmission of these infections, with the primary goal of achieving national eradication of mother-to-child transmission. Central to the realization of these strategies was the aspiration to maintain the HIV/AIDS epidemic in China at low levels. The evolution of HIV/AIDS policies and their consequent implementation reflect an increased level of comprehensiveness, diversity, specificity, and institutionalization within the public health infrastructure of China (*6*,*13*–*17*).

Over the past four decades, China has made considerable progress in HIV/AIDS prevention and control efforts, paralleling the nation's socioeconomic development. Evidence-based scientific advancements have been pivotal in informing policy development and execution. The approach to HIV/AIDS prevention and control has matured into a forward-thinking, proactive model that emphasizes cooperation among social communities (*18*). China's government authorities have taken an active role in coordinating with various stakeholders to draft, disseminate, implement, and evolve policy measures. Social communities, recognized for their deep community engagement, adaptive approaches, and innovative problem-solving, have established a synergistic relationship with governmental and professional entities, fostering an environment of mutual support, complementarity, and shared benefits (*19*–*20*). In 1995, China initiated sentinel surveillance specifically targeting key populations at risk for HIV/AIDS. Presently, prevention and control initiatives encompass the entire lifespan, from infants to the elderly. As of 2022, there have been 10.7 million reported cases of HIV/AIDS, with 48.1% occurring in individuals aged 50 and above (*21*). Despite this, the term "older adults" remains underrepresented in the discourse. Analysis reveals that, over the last ten years, the prevalence of HIV/AIDS in the over-60 demographic has been increasing, with nearly half of these older adults diagnosed at an advanced stage of the infection (*16*,*21*). Several factors contribute to this trend. Common societal perceptions suggest that older adults are less likely to engage in sexual activity or substance abuse, thereby masking their risk profile. Furthermore, older adults face numerous barriers to obtaining sexual health information and to the early detection of HIV/AIDS (*21*–*22*). Policy initiatives concerning HIV/AIDS prevention and control have traditionally overlooked this age group, leading to a general lack of awareness and safety among older adults in the context of sexual health. Additionally, life circumstances such as widowhood and isolation may drive an increase in commercial sex-seeking behaviors among this population (*22*–*24*). With the acceleration of China's aging process and the demographic shift toward a younger-elderly populace, it is crucial to develop and implement tailored HIV/AIDS health education and promotion strategies for older adults (*25*–*26*). This demographic now constitutes over half of the senior population, prompting an urgent need for appropriate intervention models to address this growing challenge.

In conclusion, this study employed a mixed-methods approach to objectively evaluate HIV/AIDS prevention and control policies in China, integrating both qualitative and quantitative assessments. By scrutinizing policy documents and the impacts of policy enactment, as well as other multifaceted metrics, the study devised an innovative sun-shaped network model for HIV/AIDS policy management. Advanced tools such as NVivo12 software and the principles of grounded theory facilitated a thorough three-tiered coding analysis of national-level HIV/AIDS policies. This methodology stands apart from previous studies that centered on chronological investigation, offering benefits in terms of comprehensiveness, currency, and analytical precision. Moreover, the study affirmed the suitability and practicality of applying grounded theory to the textual analysis of these policies within the Chinese context. Despite these strengths, some limitations were noted. Consequently, future research endeavors will integrate interviews, semi-structured interviews, and additional evaluative techniques to thoroughly appraise aspects of policy design, issuance, impact, funding, and program development. The objective is to underpin the formulation of HIV/AIDS policies with robust scientific evidence and articulate strategic recommendations to enhance their effectiveness in China.

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REFERENCES

1. Wang KR, Li X, Han J, Su Y. Changes in HIV/AIDS care under the guidance of Chinese policy. Chin Nurs Manage 2021;21(12):1810 – 4. http://dx.doi.org/10.3969/j.issn.1672-1756.2021.12.011. (In Chinese).
2. Jia P. HIV/AIDS related major topics concerning law, ethics and public policy in China, 2018-2019. Chin J AIDS STD 2020;26(4):455 – 7. http://dx.doi.org/10.13419/j.cnki.aids.2020.04.32. (In Chinese).
3. Jia P. HIV/AIDS Law and Policy in China—An overview from perspective of rights protection and vulnerable groups. Chin J AIDS STD 2016;22(3):222 – 4. http://dx.doi.org/10.13419/j.cnki.aids.2016.03.25. (In Chinese).
4. Han MJ. Analysis and prevention prospect of AIDS epidemic situation in China. Chin J AIDS STD 2023;29(3):247 – 50. http://dx.doi.org/10.13419/j.cnki.aids.2023.03.01. (In Chinese).
5. Glaser BG, Strauss AL, Strutzel E. The discovery of grounded theory; strategies for qualitative research. Nurs Res 1968;17(4):364. http://dx.doi.org/10.1097/00006199-196807000-00014.
6. Xu P, Han L, Zeng G, Ma FC, Liu KM, Lv F. Prevention and control of sexually transmitted HIV/AIDS in China: policy evolution and trends. Chin J Health Policy 2013;6(7):64 – 70. http://dx.doi.org/10.3969/j.issn.1674-2982.2013.07.011. (In Chinese).
7. Meng JM. An analysis of China's HIV/AIDS prevention and treatment law and policies. J Shantou Univ Humanit Soc Sci Ed 2016;32(3):58–64. https://kns.cnki.net/kcms2/article/abstract?v=M9N_p6ifsvM5Q_r6pOC1ivPrBiStL3XRNrmKyMHyLZu1Xt3-kRLV7E3pn9deLozUm6huq93L8M43em9csE2PffzXxoBsPtr4GV1M2qbGKIxiEWdkfk42HGDJOen8wxHn&uniplatform=NZKPT&language=gb. (In Chinese).
8. Zhneg LQ, Chen QF, Shen J. Retrospection of the development of AIDS prevention and control policies and strategies in China. Chin J AIDS STD 2019;25(7):657 – 61. http://dx.doi.org/10.13419/j.cnki.aids.2019.07.01. (In Chinese).
9. Zhao Y, Ma Y, Chen R, Qin X, Hu Z. The policy analysis of HIV/AIDS prevention and control. Chin Health Serv Manage 2015;32(2):114 – 7,159. https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7ir5D84hng_y4D11vwp0rrtdXJQR0Xy0lYsf7QBAtDNXTT2gKWmbKUo_4SmCl4GEAu&uniplatform=NZKPT. (In Chinese).
10. Ma Y, Li ZZ, Zhang KX, Yang WQ, Ren XH, Yang YF, et al. HIV was first discovered among injection drug users in China. Chin J Epidemiol 1990;11(3):184 – 5. http://chinaepi.icdc.cn/zhlxbx/ch/reader/view_abstract.aspx?file_no=19900316&flag=1. (In Chinese).
11. Wang LD. Carry out the the regulations on the prevention and treatment of HIV/AIDS in earnest and carry out the comprehensive HIV/AIDS prevention and control work in full compliance with the law. Health Government Briefings. [about 1 screen]. https://www.chinaaids.cn/jb/zcfg/azbfztl/ssjz/201301/t20130111_75800.htm. [2023-06-01]. (In Chinese).
12. Four free and one care policy brings hope to people living with HIV—Interview Wu Zunyou, director of national center for AIDS/STD control and prevention, China CDC. Information on AIDS Prevention and Treatment in China. 2013. https://ncaids.chinacdc.cn/zyxz/dzkw/201312/t20131220_91608.htm. [2023-06-01]. (In Chinese).
13. Gao SQ, Zhu YQ, Huang Y. The 40-year road of deepening reform and opening up. 2018. China Economic Herald. https://www.ndrc.gov.cn/fggz/fgjh/zthd/201811/t20181128_1094945_ext.html. [2018-10-25]. (In Chinese).
14. Guan XP. The practice and experience of the communist party's social policy in the past century. Soc Sci China 2022;(2):103-22. https://kns.cnki.net/kcms2/article/abstract?v=M9N_p6ifsvPimNgPmT-z3P3BtoQ4WewTxdAgTmsEpO3HH66m8HX8kM0Oqm2nOY3ZE0cxT_TQR59ktPjh8z271KxkM5Ucr4X7p4_ZRYSfwigTTh_fnZCIWPpI_GfsMR5X&uniplatform=NZKPT&language=gb. (In Chinese).
15. Wang SB. Essential features and development of the discipline of social policy in China. Sociol Stud 2019;34(4):10 – 9. http://dx.doi.org/10.19934/j.cnki.shxyj.2019.04.002. (In Chinese).
16. Wu ZY. HIV/AIDS prevention strategy with Chinese characteristics. Chin J Dis Control Prev 2019;23(8):885 – 9. http://dx.doi.org/10.16462/j.cnki.zhjbkz.2019.08.001. (In Chinese).
17. Yue JL. China's recent social policy expansion and the future of "Social China". Soc Policy Res 2016(1):51 – 62. http://dx.doi.org/10.19506/j.cnki.cn10-1428/d.2016.01.007. (In Chinese).
18. Sun Q, Cheng JQ, Xu XJ. Evolution of whole society participation in AIDS prevention and control in China: a brief discussion. Chin J Public Health 2022;38(12):1630 – 5. http://dx.doi.org/10.11847/zgggws1138899. (In Chinese).
19. Fa CW, Sha S, Dai SY, Ren JH, Xue WL, Yang WH, et al. The participation of community-based organization in the first-line prevention and treatment of HIV/AIDS. Chin Prev Med 2022;23(7):521 – 4. http://dx.doi.org/10.16506/j.1009-6639.2022.07.008. (In Chinese).
20. Sha S, Dai SY, Li JF, Yang WH, Jin JY, Zheng WL, et al. The effectiveness and prospect of social organization in the field of HIV/IDS prevention and treatment in China. Chin J AIDS STD 2022;28(10):1119 – 21. http://dx.doi.org/10.13419/j.cnki.aids.2022.10.01. (In Chinese).
21. The Lancet Healthy Longevity. Ageing with HIV. Lancet Healthy Longevity 2022;3(3):e119. http://dx.doi.org/10.1016/S2666-7568(22)00041-1.
22. Wang CP, Guo Q, Han ZR, Chen DY. Awareness rate of HIV/AIDS core knowledge among the elderly: a meta-analysis. Chin J AIDS STD 2019;25(2):148 – 52. http://dx.doi.org/10.13419/j.cnki.aids.2019.02.10. (In Chinese).
23. Wei FS, Zhu GJ, Xu ZL, Qin XL, Qin CW, Huang YX, et al. Analysis on knowledge, attitudes and practices toward HIV/AIDS among rural left-behind elderly people in Guigang City. Occup Health 2017;33(2):208 – 10,215. http://dx.doi.org/10.13329/j.cnki.zyyjk.2017.0062. (In Chinese).
24. Tan XL. Discussion on the status of HIV infection in elderly women in China and. Appl Prev Med 2016;22(3):286 – 8. https://doi.org/10.3969/j.issn.1673-758X.2016.03.034. (In Chinese).
25. Ge YF, Wang LJ, Feng WM, Zhang BZ, Liu SL, Ke YH. The challenge and strategy selection of healthy aging in China. J Manage World 2020;36(4):86 – 95. http://dx.doi.org/10.19744/j.cnki.11-1235/f.2020.0055. (In Chinese).
26. The Aged Health Division. 2020 national aging development bulletin [about 1 screen]. http://www.nhc.gov.cn/lljks/pqt/202110/c794a6b1a2084964a7ef45f69bef5423.shtml. [2023-06-01]. (In Chinese).

Notifiable Infectious Diseases Reports

Reported Cases and Deaths of National Notifiable Infectious Diseases — China, November 2023*

Diseases	Cases	Deaths
Plague	1	0
Cholera	0	0
SARS-CoV	0	0
Acquired immune deficiency syndrome†	5,664	1,955
Hepatitis	156,977	327
Hepatitis A	1,056	0
Hepatitis B	132,270	35
Hepatitis C	20,280	292
Hepatitis D	19	0
Hepatitis E	2,751	0
Other hepatitis	601	0
Poliomyelitis	0	0
Human infection with H5N1 virus	0	0
Measles	78	0
Epidemic hemorrhagic fever	1,320	3
Rabies	12	14
Japanese encephalitis	12	2
Dengue	1,685	0
Anthrax	36	0
Dysentery	1,963	1
Tuberculosis	57,432	320
Typhoid fever and paratyphoid fever	377	0
Meningococcal meningitis	12	0
Pertussis	6,410	2
Diphtheria	0	0
Neonatal tetanus	1	0
Scarlet fever	4,637	0
Brucellosis	4,540	0
Gonorrhea	10,065	0
Syphilis	57,719	1
Leptospirosis	25	0
Schistosomiasis	3	0
Malaria	183	0
Human infection with H7N9 virus	0	0
Monkey pox§	80	0
Influenza	1,862,998	1
Mumps	7,642	0

Continued

Diseases	Cases	Deaths
Rubella	89	0
Acute hemorrhagic conjunctivitis	4,940	0
Leprosy	34	0
Typhus	170	0
Kala azar	19	0
Echinococcosis	387	0
Filariasis	0	0
Infectious diarrhea[¶]	73,835	0
Hand, foot and mouth disease	92,955	0
Total	2,352,301	2,626

* According to the National Bureau of Disease Control and Prevention, not included coronavirus disease 2019 (COVID-19).
† The number of deaths of acquired immune deficiency syndrome (AIDS) is the number of all-cause deaths reported in the month by cumulative reported AIDS patients.
§ Since September 20, 2023, Monkey pox was included in the management of Class B infectious diseases.
¶ Infectious diarrhea excludes cholera, dysentery, typhoid fever and paratyphoid fever.
The number of cases and cause-specific deaths refer to data recorded in National Notifiable Disease Reporting System in China, which includes both clinically-diagnosed cases and laboratory-confirmed cases. Only reported cases of the 31 provincial-level administrative divisions in Chinese mainland are included in the table, whereas data of Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan, China are not included. Monthly statistics are calculated without annual verification, which were usually conducted in February of the next year for de-duplication and verification of reported cases in annual statistics. Therefore, 12-month cases could not be added together directly to calculate the cumulative cases because the individual information might be verified via National Notifiable Disease Reporting System according to information verification or field investigations by local CDCs.

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