Preplanned Studies

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

Dandan Yang[1,2,&]; Jing Lu[2,&]; Zhi Zhang[2]; Chuanwu Sun[3]; Zhuping Xu[4]; Yao Qi[5]; XiaoXia Liu[6]; Huan Ding[4]; Feifei Chai[3]; Zhengdong Zhang[1,#]; Baoli Zhu[1,2,#]

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.

Acknowledgments: All the participants for their support and contributions to this study.

doi: 10.46234/ccdcw2024.001

[#] Corresponding authors: Zhengdong Zhang, zdzhang@njmu.edu.cn; Baoli Zhu, zhublcdc@sina.com.

[1] Department of Genetic Toxicology, The Key Laboratory of Modern Toxicology of Ministry of Education, Center for Global Health, School of Public Health, Nanjing Medical University, Nanjing City, Jiangsu Province, China; [2] Department of Sexually Transmitted Diseases and AIDS, Center for Disease Control and Prevention of Jiangsu Province, Nanjing City, Jiangsu Province, China; [3] Department of Sexually Transmitted Diseases and AIDS, Center for Disease Control and Prevention of Xuzhou, Xuzhou City, Jiangsu Province, China; [4] Department of Sexually Transmitted Diseases and AIDS, Center for Disease Control and Prevention of Wuxi, Wuxi City, Jiangsu Province, China; [5] Department of Sexually Transmitted Diseases and AIDS, Center for Disease Control and Prevention of Yancheng, Yancheng City, Jiangsu Province, China; [6] Department of Sexually Transmitted

Diseases and AIDS, Center for Disease Control and Prevention of Zhenjiang, Zhenjiang City, Jiangsu Province, China.
[&] Joint first authors.

Submitted: September 06, 2023; Accepted: December 08, 2023

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.