

Comprehensive Prevention and Control Service Capacity for Hepatitis B in Medical and Health Institutions: A Cross-Sectional Survey in Jiangsu Province, China

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Abstract

Background

Despite substantial progress in hepatitis B virus (HBV) prevention in China, important gaps remain in diagnosis, referral, treatment, and long-term follow-up. To further strengthen viral hepatitis prevention and control, the National Administration of Disease Control and Prevention formulated the Action Plan for the Prevention and Control of Viral Hepatitis in China (2025–2030) in 2025. Jiangsu Province is classified as a region with moderate endemicity of HBV in China. The capacity of medical and health institutions to deliver comprehensive HBV prevention and control services is essential for effective implementation of HBV control strategies. This study aimed to assess the capacity of medical and health institutions in Jiangsu Province across key components of the HBV prevention and control service chain, including testing, diagnosis reporting, referral, antiviral treatment and follow-up management.

Methods

A cross-sectional survey was conducted across all 13 prefecture-level cities in Jiangsu Province, encompassing 183 medical and health institutions—comprising 135 hospitals and 48 disease control and prevention centers (CDCs). The survey encompassed the following core items: Hepatitis B surface antigen (HBsAg) testing, HBV-DNA testing, case diagnosis, case referral, antiviral treatment, patient follow-up, and public health prevention and control initiatives implemented by CDCs.

Results

Among the 183 surveyed institutions, 86.9% (159/183) reported having the capacity to perform HBsAg testing. In 2025, a total of 3.75 million HBsAg tests had been completed, over 90% of which were carried out in tertiary hospitals. HBV-DNA testing was available in 56.8% (104/183) of the surveyed institutions, and all primary hospitals offering this service outsource testing to independent clinical laboratories. Case referral services were provided by 37.2% (68/183) of the institutions, with antiviral treatment resources highly concentrated in tertiary hospitals. Follow-up management was implemented in 34.1% (46/135) of hospitals, mainly among tertiary hospitals.

Conclusion

Medical and health institutions in Jiangsu Province have established relatively strong capacity for HBV laboratory testing, particularly for HBsAg testing. However, HBV treatment and follow-up services remain highly concentrated in tertiary hospitals, indicating limited participation of primary-level institutions in long-term HBV management. Future efforts should focus on strengthening the HBV prevention and control service chain by unifying clinical diagnostic criteria, enhancing referral mechanisms, expanding grassroots follow-up capacity, and promoting coordinated information sharing between healthcare institutions and CDCs.

1. Background

Viral hepatitis represents a major global public health challenge because of its substantial disease burden and complex transmission patterns. Notably, the health burdens resulting from hepatitis B virus (HBV) infection constitute one of the most pressing global public health challenges[1]. In response to this burden, the World Health Assembly has set a target of eliminating viral hepatitis as a public health threat by 2030[2]. However, the global epidemic of HBV infection remains a serious concern. According to the World Health Organization (WHO), an estimated 240 million people were living with chronic hepatitis B infection in 2024, with approximately 1.1 million people died from cirrhosis or hepatocellular carcinoma (HCC) related to HBV infection, resulting in substantial morbidity and mortality and placing a substantial burden on individuals, healthcare systems, and society.[3].

China has the largest number of HBV infections in the Western Pacific region[4]. Correspondingly, chronic hepatitis B imposes enormous socioeconomic pressure on Chinese society[5]. To reduce new HBV infections, the Chinese government has provided hepatitis B vaccination for newborns since 1992[6]. Since then, the population prevalence of hepatitis B surface antigen (HBsAg) has declined steadily[7]. Nevertheless, the substantial burden of adult chronic hepatitis B virus (HBV) infection persists, posing ongoing challenges to public health systems and straining clinical and financial healthcare resources[8]. Although China has implemented a comprehensive suite of policies for hepatitis prevention and control, a substantial proportion of individuals with chronic hepatitis B remain undetected, undiagnosed, and inadequately managed[9]. A serosurvey conducted by Zheng et al[10] in China revealed that only 59.78% of infected individuals were aware of their HBsAg-positive status. Among those who knew they were infected, 38.25% met the indications for antiviral treatment, and of those eligible for treatment, merely 17.33% were receiving antiviral therapy. These findings collectively indicate substantial gaps across the HBV prevention and control service chain in China.

In this context, the National Administration of Disease Control and Prevention issued the Action Plan for the Prevention and Control of Viral Hepatitis in China (2025–2030) in 2025[9], which explicitly calls for continuously strengthening the immunization barrier, improving the rates of detection, diagnosis reporting, and treatment, steadily reducing new infections, and enhancing the overall effectiveness of viral hepatitis prevention and control[11]. Notably, the plan further sets forth requirements for strengthening the service system and institutional capacity. For instance, medical and health institutions should provide testing services for populations at high risk of viral hepatitis infection, and offer necessary confirmatory diagnosis and antiviral treatment to those who test positive; institutions lacking the requisite capacity should make timely referrals. The plan also emphasizes strengthening capacity for hepatitis B surface antigen (HBsAg) and HBV nucleic acid testing, promoting mutual recognition of test results across medical institutions, and reinforcing standardized case reporting as well as surveillance and evaluation. In terms of treatment services, the action plan further proposes optimizing diagnosis and treatment workflows, improving the quality of standardized antiviral treatment, providing follow-up care and monitoring for adverse clinical outcomes, and advancing tiered diagnosis and treatment for hepatitis B by establishing a two-way referral mechanism between hospitals and primary-level medical and health institutions. It also stresses the coordination between disease control institutions, medical institutions, and primary-level health facilities, with disease control institutions guiding and supervising the delivery of whole-course health services for patients with hepatitis B. In a word, these requirements indicate that achieving the goals of hepatitis B prevention and control requires not only capacity building at individual medical institutions, but more importantly, the formation of a well-coordinated, clearly accountable comprehensive prevention and control service system across different levels of medical institutions and disease control agencies.

Jiangsu Province features a high level of economic and social development, relatively abundant medical and health resources, and a large population, leading to prominent demand for hepatitis B prevention and control services[12]. The resource allocation and capacity building of medical and health institutions in Jiangsu Province directly determine the effectiveness of regional HBV prevention and control. However, existing studies in China have largely focused on population-level prevalence, diagnosis and treatment coverage, or patient-level barriers, whereas evidence on the distribution and coordination of HBV-related service capacity across different types and levels of health institutions remains limited. Therefore, this study adopts an institutional perspective along the continuum of hepatitis B prevention and care services to systematically assess the capacity of medical and health institutions in delivering HBsAg and HBV-DNA testing, case reporting, referral, antiviral treatment, and patient follow-up management. The findings will provide an evidence base for further optimizing the allocation of hepatitis B prevention and control resources in Jiangsu Province, improving the mechanisms for medical-care and disease-prevention coordination as well as tiered diagnosis and treatment, and strengthening the comprehensive service capacity of hepatitis B prevention and control.

2. Methods

2.1 Sampling method

A multistage sampling design was used. At the first stage, all 13 prefecture-level cities in Jiangsu Province were included. At the second stage, within each city, three counties (or county-level cities/districts) were purposively selected, specifically the top 2 and the bottom 1 in terms of reported hepatitis B cases in 2025. At the third stage, one tertiary general hospital, one secondary general hospital, and one primary hospital were selected from each selected district (or county). Municipal-level infectious disease hospitals and maternal and child healthcare centers were also included. Finally, the municipal-level and district (county)-level centers for disease control and prevention, which cover all 13 prefecture-level cities and all selected districts (counties), were comprehensively incorporated into the survey.

2.2 Data collection

The “Healthcare Institution Survey Questionnaire” (Further details are presented in Supplementary Material 1) was developed in accordance with the national Guidelines for the Prevention and Treatment of Hepatitis B. Trained investigators administered the questionnaire in person to designated personnel responsible for HBV prevention and control at each institution. For each institution, one questionnaire was completed using information provided by multiple key informants, including clinicians, laboratory managers, and public health coordinators. The core survey domains encompassed: (1) Number of HBsAg tests and positivity rate in 2025, including assay methodology; (2) Number of HBV-DNA tests and positivity rate in 2025, including assay methodology; and (3) longitudinal follow-up management practices for diagnosed hepatitis B patients. Additionally, corresponding questions were tailored to medical institutions and disease control institutions respectively, based on the characteristics of each institution type.

The Department of HIV/STD Prevention and Control, Jiangsu Provincial Center for Disease Control and Prevention, is responsible for training the investigators from each prefecture-level city who participated in the current hepatitis prevention and control situation survey. The training content included: basic knowledge and prevention knowledge of hepatitis B, basic ethical knowledge, the purpose, methods, content and steps of this survey, precautions during the survey process, and precautions for filling out the questionnaire. After each

questionnaire was completed, the investigators checked its completeness and corrected any missing or incorrect items. After the survey was completed, the data were entered into the unified online database.

2.3 Data analysis

Data entry of the collected questionnaires was performed using Epidata 3.1, and data cleaning and statistical analyses were conducted using Microsoft Excel 2021 and R version 4.4.2. Categorical variables were summarized as frequencies and percentages. Differences in proportions between groups were assessed using Pearson's chi-square test. When the expected cell counts did not meet the assumptions of the chi-square test, Fisher's exact test was used instead. All statistical tests were two-sided, and $P < 0.05$ was considered statistically significant.

2.4 Ethics statement

This survey was conducted according to the Helsinki Declaration. This survey was solely aimed at understanding the basic situation of hepatitis B prevention and control in medical institutions and information on the capacity of these institutions' HBV testing. It serves operational public health objectives and is categorized as active surveillance related to disease prevention and control. This activity forms part of the routine work of the CDC. No individual-level or personally identifiable information was collected. All participants involved in this survey have signed informed consent. Therefore, the Ethics Committee of the Jiangsu Center for Disease Prevention and Control waived the requirement for full ethical review for this study.

3. Results

3.1 Basic information of the surveyed institutions

A total of 184 institutional questionnaires were collected; after excluding one invalid response, 183 were retained for analysis, yielding a valid questionnaire rate of 99.5%. Tertiary hospitals contributed the largest share of valid responses ($n = 55$, 30.1%), followed by CDCs ($n = 48$, 26.2%), secondary hospitals ($n = 44$, 24.0%), and primary hospitals ($n = 36$, 19.7%). The geographic and institutional distribution of respondents is presented in Fig. 1.

3.2 Laboratory testing capacity for HBV

3.2.1 HBsAg testing

Of the 183 surveyed institutions, 86.9% (159/183) reported the capacity to perform HBsAg testing. Among these, 150 conducted HBsAg testing in-house, whereas 9 outsourced testing to independent clinical laboratories, including 5 primary hospitals, 2 secondary hospitals, and 2 tertiary hospitals. Among the 48 CDCs surveyed, only 50.0% (24/48) conducted HBsAg testing, all exclusively in-house. A statistically significant difference in HBsAg testing capability was observed across institutional types ($\chi^2 = 46.7$, $P < 0.001$). However, when comparing only primary, secondary, and tertiary hospitals, the difference in testing capability was not statistically significant ($\chi^2 = 4.1$, $P = 0.126$).

In 2025, a total of 3,754,191 HBsAg tests were performed across surveyed institutions. Among these, 318,722 tested positive, yielding an overall positivity rate of 8.5%. Testing volume was distributed as follows: 1.5% in primary hospitals, 7.5% in secondary hospitals, 90.5% in tertiary hospitals, and 0.5% in CDCs. Tertiary hospitals

reported the highest positivity rate (8.9%), whereas CDCs reported the lowest (3.4%). Detailed results are presented in Table 1.

Table 1

HBsAg testing and positive rate in surveyed institutions in 2025 ^a

Conducted in-house	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	CDCs(n = 24)	Total (N = 159)	Statistical test ^b	P-Value
						46.7	< 0.001
Yes	31(86.1)	42(95.5)	53(96.4)	24(100.0)	150(94.3)		
No	5(13.9)	2(4.5)	2(3.6)	0(0.0)	9(5.7)		
Number of tested individuals	55654(1.5)	281603(7.5)	3399457(90.5)	17477(0.5)	3754191		
Number of positive tests	2026(0.7)	13228(4.1)	302873(95.0)	595(0.2)	318722		
Positive rate	3.6%	4.7%	8.9%	3.4%	8.5%		

a The table includes only institutions that routinely conduct HBsAg testing;

b The table shows only the chi-square values for comparisons across institutional types.

By testing methods, gold immunochromatography assay (GICA) HBsAg testing was available at 74.2% (23/31) of primary hospitals. Among these, five institutions also offered chemiluminescence immunoassay (CLIA), and two offered enzyme-linked immunosorbent assay (ELISA). Among secondary hospitals, CLIA was the most widely adopted method (73.8%, 31/42), followed by GICA (64.3%, 27/42) and ELISA (28.6%, 12/42). Immunofluorescence assay (IFA) and electrochemiluminescence immunoassay (ECLIA) were each available at only two secondary hospitals. Among the 53 tertiary hospitals performing HBsAg testing in-house, CLIA remained predominant (88.7%, 47/53), with rapid testing and ELISA available at 43.4% (23/53) and 22.6% (12/53), respectively; ECLIA was offered by 17.0% (9/53), and IFA by 7.5% (4/53). Among the 24 CDCs, GICA was nearly universal (91.7%, 22/24), while ELISA was available at 62.5% (15/24). Comprehensive method availability across institution types is summarized in Fig. 1 and Table 2.

Table 2
Testing methods for HBsAg in surveyed institutions ^a

Testing Methods	Primary Hospitals (n = 31)	Secondary Hospitals(n = 42)	Tertiary Hospitals(n = 53)	CDCs(n = 24)	Total(N = 150)
GICA	23(74.2)	27(64.3)	23(43.4)	22(91.7)	95(63.3)
ELISA	2(6.5)	12(28.6)	12(22.6)	15(62.5)	41(27.3)
IFA	0(0.0)	2(4.8)	4(7.5)	1(4.2)	7(4.7)
CLIA	5(16.1)	31(73.8)	47(88.7)	1(4.2)	84(56.0)
ECLIA	0(0.0)	2(4.8)	9(17.0)	0(0.0)	11(7.3)

^a Only institutions conducting HBsAg testing in-house are included in the count.

3.2.2 HBV-DNA testing

56.8% (104/183) of surveyed institutions offered HBV-DNA testing, with 50.0% (52/104) conducting the tests in-house and the remainder outsourcing them to independent clinical laboratories. Among the 52 institutions performing HBV-DNA testing in-house, 96.2% (50/52) provided quantitative HBV-DNA testing, including 37 offering standard testing and 22 offering high-sensitivity testing, with some institutions offering both standard- and high-sensitivity testing.

Among the 36 primary hospitals surveyed, 47.2% (17/36) offered HBV-DNA testing, all of which were outsourced to independent clinical laboratories. Among the 44 secondary hospitals, 70.5% (31/44) provided HBV-DNA testing; of these, 5 conducted testing in-house, while the remaining 26 outsourced testing. All 55 tertiary hospitals surveyed offered HBV-DNA testing, with 46 conducting testing in-house and 9 outsourcing it. Of the 48 CDCs, only 1 provided HBV-DNA testing, and this was performed in-house. A statistically significant difference in HBV-DNA testing provision was observed across institutional types ($P < 0.001$). The difference remained statistically significant when the analysis was restricted to primary, secondary, and tertiary hospitals ($\chi^2 = 34.7$, $P < 0.001$).

In 2025, a total of 354,356 HBV-DNA tests were performed across surveyed institutions; among them, 115,861 tested positive, yielding an overall positivity rate of 32.7%. Testing volume was distributed as follows: primary hospitals tested 410 individuals (0.1% of the total), secondary hospitals tested 12,762 individuals (3.6%), tertiary hospitals tested 341,183 individuals (96.3%). The highest positivity rate was observed in primary hospitals (65.9%), followed by tertiary hospitals (33.1%) and secondary hospitals (21.7%). Detailed results are presented in Table 3.

Table 3

HBV-DNA testing and positive rate in surveyed institutions in 2025 ^a

Conducted in-house	Primary Hospitals (n = 17)	Secondary Hospitals(n = 31)	Tertiary Hospitals(n = 55)	CDCs(n = 1)	Total (N = 104)	P-value ^b
						< 0.001
Yes	0(0.0)	5(16.1)	46(83.6)	1(100.0)	52(50.0)	
No	17(100.0)	26(83.9)	9(16.4)	0(0.0)	52(50.0)	
Number of tested Individuals	410(0.1)	12762(3.6)	341183(96.3)	1(0.0)	354356	
Number of positive tests	270(0.2)	2770(2.4)	112821(97.4)	0(0.0)	115861	
Positive rate	65.9%	21.7%	33.1%	0.0%	32.7%	

^a The table includes only institutions that offered HBV-DNA testing;

^b Fisher's exact test was used.

3.3 Hepatitis B case diagnosis reporting and referral

(Case diagnosis, antiviral treatment, and patient follow-up were analyzed across 135 hospitals, whereas case referral practices were assessed across all 183 surveyed institutions, including 135 hospitals and 48 CDCs.)

Among the 135 hospitals that reported hepatitis B cases, 58.5% (79/135) used the Diagnostic Criteria for Viral Hepatitis B (WS 299–2008) as their primary basis for case diagnosis reporting, 19.3% (26/135) applied the Management Specifications for Infectious Disease Information Reporting (2015 Edition), and 19.3% (26/135) followed the Guidelines for the Prevention and Control of Chronic Hepatitis B (2022 Edition). With regard to reporting departments, the proportion of institutions assigning case reporting responsibility to the first-visit department was highest among tertiary hospitals (76.4%), followed by primary hospitals (50.0%) and secondary hospitals (47.7%). Among institutions engaged in hepatitis B case diagnosis reporting, 35.6% (48/135) designated to the P department, such as prevention and control department, public health department, or disease control department; 4.4% (6/135) assigned this function to other departments. Detailed results are presented in Table 4.

Table 4
Case diagnosis reporting in surveyed hospitals

Diagnostic criteria	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	Total(N = 135)
Diagnostic Criteria for Viral Hepatitis B (WS 299–2008)	21(61.1)	22(50.0)	36(65.5)	79(58.5)
Management Specifications for Infectious Disease Information Reporting (2015 Edition)	7(19.4)	13(29.5)	6(10.9)	26(19.3)
Guidelines for the Prevention and Control of Chronic Hepatitis B (2022 Edition)	6(16.7)	8(18.2)	12(21.8)	26(19.3)
Others ^a	2(2.8)	1(2.3)	1(1.8)	4(2.9)
Reporting departments				
First-visit department	18(50.0)	21(47.7)	42(76.4)	81(60.0)
P department ^b	16(44.4)	20(45.5)	12(21.8)	48(35.6)
Others ^c	2(5.6)	3(6.8)	1(1.8)	6(4.4)

^a Selecting this means that all of the above three are considered as basis for case reporting;

^b The P department includes the Prevention and Control Department, the Public Health Department, or the Disease Control Department.

^c Others include: Medical Department, Hospital Infection Management Department, Infection Management Office, etc.

Among the 183 surveyed institutions, 37.2% (68/183) provided hepatitis B case referrals, while 62.8% (115/183) did not. Among the 68 institutions offering referrals, 44 informed patients verbally, 18 issued standardized referral forms, and 6 proactively contacted the receiving institutions. Following referral, 44.1% (30/68) conducted case follow-up, whereas 55.9% (38/68) did not. Institution-level referral rates were as follows: 22 of 36 primary hospitals, 19 of 44 secondary hospitals, 24 of 55 tertiary hospitals, and 3 of 48 CDCs. Among institutions that provided referrals, 50.0% of primary hospitals, 31.6% of secondary hospitals, and 54.2% of tertiary hospitals conducted post-referral follow-up; none of the CDCs did so. Detailed results are presented in Table 5.

Table 5
Case referrals in surveyed institutions

Case Referrals	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	CDCs(n = 48)	Total(N = 183)
Yes	22(61.1)	19(43.2)	24(43.6)	3(6.3)	68(37.2)
No	14(38.9)	25(56.8)	31(56.4)	45(93.7)	115(62.8)
Referral methods					
Informed patients	13(59.1)	14(73.7)	14(58.4)	3(100.0)	44(64.7)
Standardized referral forms	8(36.4)	2(10.5)	8(33.3)	0(0.0)	18(26.5)
Contacted the receiving institutions	1(4.5)	3(15.8)	2(8.3)	0(0.0)	6(8.8)
Follow-up of referred cases					
Yes	11(50.0)	6(31.6)	13(54.2)	0(0.0)	30(44.1)
No	11(50.0)	13(68.4)	11(45.8)	3(100.0)	38(55.9)

3.4 Antiviral treatment for patients with HBV

Among the 135 surveyed hospitals, 51.1% (69/135) offered antiviral treatment for patients with HBV, including 7 primary hospitals, 14 secondary hospitals, and 48 tertiary hospitals. A statistically significant disparity was observed in the provision of antiviral therapy across institutional levels ($\chi^2 = 49.8$, $P < 0.001$). In 2025, a total of 121,987 antiviral treatment visits were reported: 702 at primary hospitals, 6,020 at secondary hospitals, and 115,265 at tertiary hospitals. A total of 974 physicians participated in antiviral management; among them, 20.3%, 31.6%, and 48.1% held junior, intermediate, and senior professional titles, respectively. Regarding drug availability, the coverage rates for entecavir (ETV), tenofovir disoproxil fumarate (TDF), tenofovir alafenamide (TAF), telbivudine (LdT), and interferon (IFN) were 82.6%, 71.0%, 55.1%, 46.4%, and 53.6%, respectively. Further details are presented in Table 6.

Table 6
Antiviral treatment for patients with HBV in surveyed hospitals

Antiviral treatment	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	Total(N = 135)	Statistical test	P-Value
					49.8	< 0.001
Yes	7(19.4)	14(31.8)	48(87.3)	69(51.1)		
No	29(80.6)	30(68.2)	7(12.7)	66(48.9)		
Number of patients receiving antiviral treatment visits in 2025	702(0.6)	6020(4.9)	115265(94.5)	121987		
Number of physicians participated in antiviral treatment	34(3.5)	139(14.3)	801(82.2)	974		
Distribution of physicians participated in antiviral treatment						
Junior	3(8.8)	16(11.5)	179(22.3)	198(20.3)		
Intermediate	12(35.3)	67(48.2)	229(28.6)	308(31.6)		
Senior	19(55.9)	56(40.3)	393(49.1)	468(48.1)		
Antiviral treatment medications provided ^a						
ETV	2(28.6)	13(92.9)	42(87.5)	57(82.6)		
TDF	2(28.6)	10(71.4)	37(77.1)	49(71.0)		
TAF	2(28.6)	4(28.6)	32(66.7)	38(55.1)		
LdT	0(0.0)	1(7.1)	31(64.6)	32(46.4)		
IFN	0(0.0)	6(42.9)	31(64.6)	37(53.6)		

a Multiple-choice question: A single medical institution may stock more than one hepatitis B antiviral agent. Drug abbreviations: ETV (entecavir), TDF (tenofovir disoproxil fumarate), TAF (tenofovir alafenamide), LdT (telbivudine), IFN (interferon).

3.5 Management of patients with HBV

Among the 135 surveyed hospitals, 34.1% (46/135) provided follow-up management for patients with HBV, with the majority of these services delivered by tertiary hospitals. No statistically significant difference was observed in follow-up service provision across institutional levels ($\chi^2 = 5.9$, $P = 0.053$). The departments most frequently responsible for follow-up management were preventive health departments (52.2%), infectious disease

departments (50.0%), and hepatology departments (43.5%). Secondary and tertiary hospitals engaged a greater number of departments in follow-up management compared with primary hospitals. Among personnel participating in follow-up management, treating physicians constituted 67.4%, nurses 39.1%, and dedicated public health staff 37.0%. Health education was the predominant element of follow-up management (95.7%), followed by scheduled clinical assessments (91.3%) and treatment initiation support (82.6%). The surveyed hospitals reported a total of 46,141 follow-up visits in 2025: 296 at primary hospitals, 1,155 at secondary hospitals, and 44,690 at tertiary hospitals. A total of 624 healthcare professionals participated in follow-up management, with the largest proportion affiliated with tertiary hospitals. Overall, 29.0%, 30.9%, and 40.1% of follow-up personnel held junior, intermediate, and senior professional titles, respectively. Further details are presented in Table 7.

Table 7
Follow-up management for patients with HBV in surveyed hospitals

Follow-up management	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	Total(N = 135)	Statistical test	P-Value
					5.9	0.053
Yes	11(30.6)	10(22.7)	25(45.5)	46(34.1)		
No	25(69.4)	34(77.3)	30(54.4)	89(65.9)		
Department responsible for follow-up management of patients ^a						
Hepatology department	0(0.0)	1(10.0)	19(76.0)	20(43.5)		
Infectious disease department	0(0.0)	3(30.0)	20(80.0)	23(50.0)		
Preventive health department	11(100.0)	6(60.0)	7(28.0)	24(52.2)		
Others ^b	0(0.0)	0(0.0)	2(8.0)	2(4.3)		
Personnel responsible for follow-up management of patients						
Physician	4(36.4)	5(50.0)	22(88.0)	31(67.4)		
Nurse	1(9.1)	3(30.0)	14(56.0)	18(39.1)		
Dedicated public health staff	8(72.7)	4(40.0)	5(20.0)	17(37.0)		
Others ^c	2(18.2)	0(0.0)	1(4.0)	3(6.5)		
Element of follow-up management ^a						
Health education	11(100.0)	9(90.0)	24(96.0)	44(95.7)		
Treatment initiation support	10(90.9)	8(80.0)	20(80.0)	38(82.6)		
Adherence to medication schedules	7(63.6)	8(80.0)	21(84.0)	36(78.3)		
Scheduled clinical assessments	8(72.7)	10(100.0)	24(96.0)	42(91.3)		

Follow-up management	Primary Hospitals (n = 36)	Secondary Hospitals(n = 44)	Tertiary Hospitals(n = 55)	Total(N = 135)	Statistical test	P-Value
					5.9	0.053
Behavioral intervention	6(63.6)	9(90.0)	20(80.0)	35(76.1)		
Number of patient follow-up visits in 2025	296(0.6)	1155(2.5)	44690(96.9)	46141		
Number of physicians participated in follow-up management	19(3.0)	33(5.3)	572(91.7)	624		
Distribution of physicians participated in follow-up management						
Junior	5(26.3)	8(24.2)	168(29.4)	181(29.0)		
Intermediate	6(31.6)	12(36.4)	175(30.6)	193(30.9)		
Senior	8(42.1)	13(39.4)	229(40.0)	250(40.1)		

a Represents multiple-choice questions, and the same medical institution may select multiple responses; b Others include institutions such as health management centers; c Others include personnel such as staff from the conduct office.

4. Discussion

This study evaluated HBV prevention and control capacities across medical and health institutions in Jiangsu Province and identified both strengths and gaps across the HBV prevention and control service chain. The findings indicate that different components of this service chain remain unevenly distributed among institutions, with strong laboratory testing capacity and specialized treatment resources concentrated mainly in tertiary hospitals, while case diagnosis, referral coordination, and grassroots follow-up management remain relatively limited. However, CDCs primarily assume surveillance and regulatory functions within the public health system, with limited direct engagement in clinical service provision. They fulfill an indispensable supportive role in ensuring reporting accuracy, providing feedback on surveillance data, and coordinating multisectoral prevention and control initiatives across healthcare institutions. Consequently, the findings of this study are best interpreted through the perspective of an HBV prevention and control service chain across institutions.

This study found that HBsAg testing coverage among healthcare institutions in the surveyed region was high: 86.9% of institutions reported capacity to perform HBsAg testing, and a cumulative total of over 3.75 million tests had been conducted by 2025, which collectively indicates robust capacity for HBV testing. Notably, tertiary hospitals accounted for over 90% of all HBsAg tests performed, underscoring their central role as the principal

setting for hepatitis B case identification. This pattern aligns with prior national evidence; Liang et al., in a nationwide seroepidemiological survey, identified opportunistic screening within clinical care settings as a major contributor to HBV case detection[13]. Descriptive analysis further revealed the highest HBsAg positivity rate among tertiary hospitals, a finding that is potentially attributable to differences in patient clinical indications and referral patterns for testing across institutional levels. However, since this study did not collect further data on patient characteristics, the underlying reasons could not be determined.

From the perspectives of testing methodology and resource distribution, substantial disparities persist across institutions of differing administrative levels. As highlighted in the World Health Organization's "Global Hepatitis Report", high-quality laboratory testing capacity constitutes a foundational requirement for achieving the 2030 goal of eliminating viral hepatitis as a public health threat[1]. At primary hospitals, HBsAg testing is predominantly conducted using rapid diagnostic tests, whereas tertiary hospitals rely chiefly on CLIA. Although rapid diagnostic tests generally exhibit lower analytical sensitivity and specificity relative to CLIA[14], their operational advantages, such as portability, minimal infrastructure requirements, and cost-effectiveness, render them appropriate for point-of-care screening. However, the relatively limited testing approaches at primary hospitals indicate room for improvement in laboratory capabilities. Inadequate capacity for HBV-DNA testing represents another key limitation identified in this study. Although over half of surveyed institutions reported offering HBV-DNA testing, only 50% perform the assay in-house; all primary hospitals depend exclusively on external laboratories. HBV-DNA testing is essential for initiating antiviral treatment and evaluating virological response in patients with chronic hepatitis B. The "Guidelines for the Prevention and Treatment of Chronic Hepatitis B (2022 Edition)" explicitly identifies HBV-DNA measurement as a cornerstone of clinical decision-making in hepatitis B management[15]. However, establishing full-scale molecular diagnostics laboratories at every primary hospital is neither feasible nor necessary. Instead, the findings underscore the need to strengthen regional coordination, specifically through optimized allocation of centralized testing resources and interoperable mechanisms for timely reporting and sharing of results across tiers of the medical system. Future strategies to improve patient access may include the development of accredited regional testing centers, cross-institutional recognition of standardized test reports within healthcare consortia, and implementation of quality-assured specimen transport protocols, which collectively support an efficient and clinically responsive HBV-DNA testing ecosystem.

One of the most critical challenges identified in this study is the inconsistency in hepatitis B diagnosis reporting. As China's clinical guidelines and diagnostic criteria for hepatitis B continue to evolve, driven by advances in medical science and the national commitment to universal access to timely and appropriate treatment, clinicians must remain current with evidence-based standards. Failure to do so may lead to inconsistencies in diagnostic criteria application, thereby compromising the accuracy of case reports. Previous studies have documented longstanding challenges in hepatitis B case diagnosis reporting, including inaccurate classification, underreporting, and duplicate reporting[16–18]. Timely and accurate case diagnosis reporting is not merely a regulatory requirement but also serves as a foundational data source for public health authorities to conduct epidemiological surveillance, estimate disease burden, and inform evidence-based prevention and control policies. To strengthen diagnosis reporting quality, targeted capacity-building initiatives including standardized training for frontline healthcare providers on hepatitis B case definition, diagnosis reporting procedures are urgently warranted. Complementary system-level interventions including embedding automated logic checks in electronic health information systems, enforcing first-visit reporting mandates, and instituting routine verification

by public health departments should be systematically implemented to enhance both the accuracy and consistency of case diagnosis reporting.

Regarding hepatitis B patient referral, only 37.2% of surveyed institutions performed case referrals, and the majority relied exclusively on verbal communication. Fewer than half conducted post-referral follow-up. Prior research has documented persistent service gaps across the HBV prevention and control service chain, including diagnosis, treatment initiation, and longitudinal follow-up, among individuals living with HBV infection [8, 19, 20]. Although certain institutions carry out clinical screening, standardized referral protocols are frequently absent, potentially leading to missed opportunities for timely specialist evaluation and evidence-based antiviral treatment. This shortfall compromises secondary prevention efforts against hepatitis B-related complications, particularly cirrhosis and hepatocellular carcinoma. Primary hospitals face particular challenges in this regard: limited access to hepatology expertise, diagnostic infrastructure, and therapeutic capacity means that, without a formalized, interoperable referral pathway, patients encounter substantial delays and discontinuities in accessing higher-level diagnostic confirmation and management. Notably, this study observed a higher referral rate among primary-level institutions compared with secondary and tertiary hospitals, which may indicate a relatively greater emphasis on referral following case identification at the primary level. In contrast, CDCs reported the lowest referral rates, consistent with their mandated functions, including epidemiological surveillance, population-level disease management, and public health program implementation, rather than direct clinical service delivery.

The study findings indicate that antiviral treatment resources for hepatitis B are predominantly concentrated in tertiary hospitals, with 87.3% offering such treatment compared with only 19.4% of primary hospitals. 94.5% of reported antiviral treatment visits occurred in tertiary hospitals, indicating a highly centralized pattern of treatment delivery. Primary hospitals face notable constraints in antiviral drug availability, particularly limited availability of some antiviral agents, underscoring persistent gaps in standardized treatment capacity at the grassroots level. To enhance equitable access to hepatitis B care in Jiangsu Province, future strategies should move beyond simply expanding the number of primary hospitals delivering antiviral treatment. Instead, priority should be given to identifying and designating select primary hospitals that possess adequate human resources, essential medications, and on-site laboratory capacity for monitoring treatment response and safety[21]. These designated centers should progressively strengthen their standardized treatment capability through structured technical support from tertiary hospitals, participation in vertically integrated medical alliances, and integration of telemedicine-enabled specialist consultation[22].

Patient follow-up management represents another critical component of the HBV prevention and control service chain requiring strengthening. In this study, only 34.1% of surveyed medical institutions provided structured follow-up services for hepatitis B patients, and by 2025, such services remained overwhelmingly concentrated in tertiary hospitals. This high degree of centralization mirrors the pattern observed for antiviral treatment delivery and underscores that long-term HBV management remains predominantly concentrated in tertiary hospitals. Previous studies have discussed the advantages and disadvantages of centralized and decentralized healthcare service delivery[23–25]. Although the centralized model facilitates the provision of high-quality care, conditions with a lifelong disease course such as hepatitis B are more suited to decentralized management[26, 27]. Accordingly, future policy and practice should explicitly delineate roles and responsibilities between tertiary and primary hospitals: tertiary hospitals should retain responsibility for diagnosing complications, managing treatment failure or resistance, and adjusting regimens for complex cases; primary hospitals should take greater

responsibility for scheduled routine follow-ups, patient education, medication adherence support, and early detection of clinical deterioration.

This study encompassed 48 disease control and prevention institutions across Jiangsu Province. The findings provide critical insights into the comprehensiveness and operational coherence of the provincial hepatitis B prevention and control system. Unlike hospitals, which primarily provide clinical diagnostic, treatment, and follow-up services, CDCs primarily perform functions related to infectious disease surveillance, standardized case reporting, outbreak investigation and analysis, and cross-sectoral public health coordination[28]. Consequently, applying uniform performance indicators spanning testing, diagnosis, reporting, treatment, and long-term management across both institutional types is methodologically unsound and operationally inappropriate. Rather, CDCs should be a key coordinating component between clinical service delivery and population-level public health governance. Their distinctive contributions include: (1) identifying emerging epidemiological trends through routine surveillance data; (2) ensuring the timeliness, completeness, and accuracy of case reporting; (3) conducting rigorous epidemiological analyses to inform evidence-based interventions; (4) facilitating bidirectional information exchange, particularly feedback of surveillance-derived intelligence, to frontline medical institutions. To strengthen system integration, future efforts must prioritize the explicit delineation of roles and responsibilities between CDCs and hospitals in four key domains: case reporting quality assurance, surveillance, information feedback, and referral coordination. This will help close persistent gaps between public health surveillance systems and clinical care pathways.

5. Conclusions

The surveyed HBV prevention and control system in Jiangsu Province remains highly centered on tertiary hospitals for specialized treatment and follow-up, with secondary and primary hospitals participating, and CDCs providing public health support. The main strengths were the relatively broad availability of HBsAg testing and the concentration of specialized treatment capacity in tertiary hospitals. However, important gaps remained in standardized diagnosis reporting, referral coordination, grassroots follow-up management, and information exchange between hospitals and CDCs. Moving forward, efforts should focus on further facilitating the rational decentralization of testing, treatment, and long-term management capabilities to grassroots levels. Concurrently, the role of CDCs in surveillance, quality review, feedback mechanisms, and collaboration between clinical care and preventive health should be strengthened. Gradually, a fully integrated HBV prevention and control service chain "detection–diagnosis reporting–referral–treatment–follow-up–surveillance" will be established, thereby providing more robust systemic support for attaining the goal of viral hepatitis elimination.

Abbreviations

HBV Hepatitis B virus

HBsAg Hepatitis B surface antigen

CDC Centers for Disease Control and Prevention

WHO World Health Organization

HCC hepatocellular carcinoma

GICA gold immunochromatography assay

CLIA chemiluminescence immunoassay

ELISA enzyme-linked immunosorbent assay

IFA Immunofluorescence assay

ECLIA electrochemiluminescence immunoassay

ETV entecavir

TDF tenofovir disoproxil fumarate

TAF tenofovir alafenamide

LdT telbivudine

IFN interferon

Declarations

Ethics approval and consent to participate

This survey was conducted according to the Helsinki Declaration. the Ethics Committee of the Jiangsu Center for Disease Prevention and Control waived the requirement for full ethical review for this study. Because this survey was conducted by the CDC to implement population-based hepatitis B prevention and control programme. It serves operational public health objectives and is categorized as active surveillance related to disease prevention and control. This activity forms part of the routine work of the CDC. All participants involved in this survey have signed informed consent. The data were analyzed and published without any identifiable information.

Consent for publication

Not applicable.

Competing interests

All of the authors agree with the results presented in this paper, and none have any conflicts of interest to declare.

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Author Contribution

YDD and SLE conceived and designed the study; KQ, JJ, LXY, and CYH participated in the implementation of the project; SLE conducted the data collection and analysis; KQ, JJ, LXY, and CYH interpreted the results; KQ, SLE, and YDD wrote the first and subsequent drafts of the paper. All authors read and approved the final paper.

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Data Availability

Data is provided within the manuscript, and the original datasets are available from the corresponding author on reasonable request.

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Figures

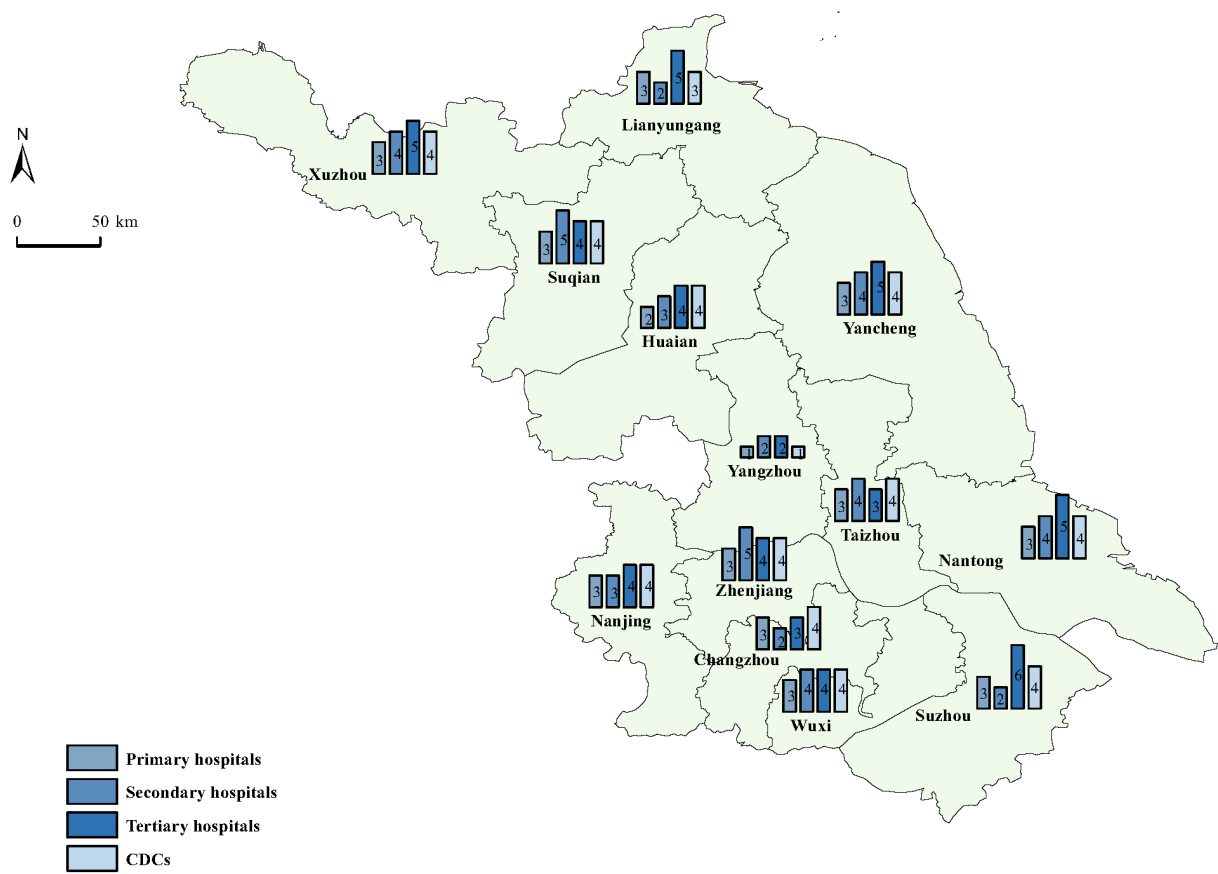


Figure1. Distribution of surveyed medical and health institutions in Jiangsu Province

Figure 1

See image above for figure legend

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