

Preplanned Studies

Supervised Analysis of Hepatitis C Virus RNA-Positive Case Reporting in County-Level Hospitals — China, 2013–2018

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Summary

What is already known on this topic?

To understand the status of the diagnosis and reporting of hepatitis C and standardize the reporting of hepatitis C cases in county-level hospitals, we conducted the first supervised analysis of hepatitis C cases in county-level hospitals in China from 2013 to 2018, covering all provincial-level administrative divisions (PLADs) except Tibet.

What is added by this report?

Through 6 years of supervision, we have obtained key data such as the nucleic acid detection rate and positive rate of hepatitis C virus (HCV) antibody positive cases in our county-level hospitals, the report rate and accuracy of HCV RNA positive cases, and standardized and improved the hepatitis C case reporting in county-level hospitals to improve data quality and provide data support for the judgment and estimation of hepatitis C in China.

What are the implications for public health practice?

By strengthening the management and supervision of hepatitis C case reporting, the reporting rate and accuracy of HCV RNA positive cases in county-level hospitals in China had been greatly improved. By combining the number of HCV antibody tests and the number of viral nucleic acid tests in medical institutions around the country, it was possible to effectively assess the current status of hepatitis C in China and to provide a scientific basis for the development of hepatitis C prevention and treatment measures.

Hepatitis C is an infectious disease that results in liver disease caused by hepatitis C virus (HCV), including acute and chronic hepatitis, liver cirrhosis, and even liver cancer. The transmission route is mainly through blood transmission, input of contaminated blood, or blood products, organ transplantation, sharing of needles by drug users, etc., and the efficiency of direct body fluid transmission and sexually

transmitted infection is low (1–2). From data from China's Infectious Disease Report Information Management System, the number of HCV cases showed rapid growth from 2004 to 2011 with an average annual increase of 48.79% (3). Due to the emergence of drugs that can completely cure hepatitis C, including those based on long-acting interferons and small molecule oral drugs, the National Health Commission of China has strengthened the prevention and treatment of hepatitis C including infectious disease case reports and clinical treatment. At the end of 2012, a department dedicated to the prevention and treatment of hepatitis C was established at the National Center for STD/AIDS Prevention and Control of China CDC. Due to the implementation of 'special disease management' for the prevention and treatment of hepatitis C, the standardized diagnostic and reporting standards for hepatitis C, and the effectively reducing excessive and repeated reporting, the number of reports from 2012–2016 was clearly flat and stable and the growth rate was 0.65% from 2012–2016 (4). According to the "Hepatitis C Diagnostic Criteria (WS 213-2018)", nucleic acid (HCV RNA) positive results can be diagnosed as a confirmed case and must be reported (5). According to the Law on the Prevention and Control of Infectious Diseases of the People's Republic of China, China's infectious disease case reporting adopts the first clinician or hospital's responsibility system. The clinician or hospital receiving the first visit is the first clinician and the first consulting hospital, and the first clinician or hospital is responsible for the diagnosis and reporting of infectious diseases of patients. Most township and community hospitals do not have the ability to diagnose infectious diseases. Therefore, the majority of county-level hospitals have become the main force of infectious disease reports in China. This study selected county-level hospitals with nucleic acid detection capabilities as survey and analysis objects. From 2013–2018, we continuously carried out verification of HCV RNA positive case reports in county-level hospitals, conducted research, and improved work

through routine supervision and improved work quality.

A county-level hospital with HCV RNA detection capability was selected as a survey object, and research work was conducted in the form of work supervision. In 2013, 7 county-level hospitals in 5 provincial-level administrative divisions (PLADs) including Hebei, Henan, Hubei, Guangdong, and Yunnan were inspected; in 2014, 217 county-level hospitals in 27 PLADs (excluding Guangdong, Yunnan, Hainan, and Tibet) were inspected; in 2015, 13 county-level hospitals in 6 PLADs including Shanxi, Inner Mongolia, Anhui, Hainan, Guizhou, and Gansu were inspected; in 2016, 25 county-level hospitals in 10 PLADs of Hebei, Jilin, Heilongjiang, Shandong, Henan, Hunan, Guangxi, Guizhou, Yunnan, and Gansu were inspected; in 2017, 30 county-level hospitals in 9 PLADs of Liaoning, Shanghai, Zhejiang, Henan, Hubei, Hunan, Guangxi, Sichuan, and Qinghai were inspected; in 2018, 19 county-level hospitals in 5 PLADs of Shandong, Yunnan, Fujian, Sichuan, and Henan were inspected. The 2013–2018 inspection covered 30 PLADs except Tibet. See [Table 1](#) for details.

In 2013 to verify hospital laboratories, we checked the RNA detection status of HCV antibody positive cases, including RNA detection rates (RNA detection number/antibody positive number) and positive rates (RNA positive number/RNA detection number). From 2013 to 2018, the laboratory of the hospital was inspected to check the HCV RNA positive list detected in the first quarter of the year. All verification was carried out when the quantity was small, and when the quantity was large, the sample was sampled by simple random sampling. The hospitals were examined on whether it had reported in the past five years from the day of the verification to the Infectious Disease Report Information Management System, and the HCV RNA positive case report rate (HCV RNA positive report number/HCV RNA positive number) was calculated. Finally, the reported cases were checked for accurately reporting confirmed cases and the accuracy of HCV RNA positive cases (HCV RNA positive report

accurate number/HCV RNA positive report number) was calculated.

The examination results in 2013 showed that 585 of the 1,856 cases of HCV antibody-positive cases were tested for HCV RNA (RNA detection rate was 31.52%), and 536 were RNA-positive (RNA positive rate was 91.62%). See [Table 1](#) for details.

From 2013 to 2018, a total of 11,946 cases that were HCV RNA positive in 30 PLADs (excluding Tibet) and 311 county hospitals were examined. The reported rates for each year from 2013–2018 were 46.83%, 52.09%, 65.59%, 53.06%, 82.10%, and 94.81%, respectively. The reported rate of HCV RNA positive cases in the 6-year average was 60.32%, which increased year by year. The accuracy rates of reports in 2013–2018 were 52.59%, 65.79%, 70.09%, 74.87%, 86.26%, and 96.12%, respectively. The accuracy rate of the 6-year average HCV RNA positive cases was 73.42%, which increased year by year. See [Table 2](#) for details.

DISCUSSION

Scientific research and investigations have found that about 10% to 15% of people infected with HCV can spontaneously eliminate the virus. Healthy people under 40 years old and women infected with HCV have higher spontaneous clearance rates, but they still tested positive for HCV antibodies (6–7). In practice, however, many clinicians do not have this knowledge and consider HCV-antibody-positive test results to indicate HCV infection, so there is an over-reporting of HCV antibody-positive cases. Simultaneously, according to the “Hepatitis C Diagnostic Criteria (WS 213-2018)”, being HCV antibody positive and fulfilling epidemiological or clinical criteria can be reported. Epidemiological criteria include patients’ reported contact with any blood, blood products, or human tissue; history of any invasive medical procedures, hemodialysis, organ transplants, or unsafe injections (including that of illicit drugs); or history of commercial blood donation, sexual contact with an HCV-infected person, and being a child born to an

TABLE 1. HCV -RNA testing of antibody positive cases in 7 inspected country hospitals in China in 2013.

Case type	Antibody positive number	RNA detection number	RNA detection rate(%)	RNA positive number	RNA positive rate(%)
Hospitalized cases	1,008	356	35.32	327	91.85
Outpatient cases	848	229	27.00	209	91.27
Total	1,856	585	31.52	536	91.62

TABLE 2. Report on HCV-RNA positive cases of hepatitis C in inspected county hospitals in China, 2013–2018.

Year	Number of PLADs [*]	Number of county hospitals	HCV-RNA positive number	HCV-RNA positive reported number	HCV-RNA positive reported rate (%)	HCV-RNA positive report accurate number	HCV-RNA positive report accurate rate (%)
2013	5	7	536	251	46.83	132	52.59
2014	27	217	7,946	4,139	52.09	2,723	65.79
2015	6	13	247	117	47.37	82	70.09
2016	10	25	360	191	53.06	143	74.87
2017	9	30	1,933	1,587	82.10	1,369	86.26
2018	5	19	924	876	94.81	842	96.12
Total	30	311	11,946	7,206	60.32	5,291	73.42

^{*} Provincial-level administrative divisions including provinces, autonomous regions, and municipalities.

HCV-infected mothers. Clinical criteria include the clinical symptoms of liver disease; elevated liver enzymes (serum aspartate aminotransferase, alanine aminotransferase, or bilirubin); B-mode ultrasounds, CT scans, or MRI imaging indicative of splenomegaly and hepatomegaly; damage to the liver parenchyma; or widening of the portal vein. Therefore, being HCV-antibody positive alone could not confirm the diagnosis of hepatitis C, and only HCV-RNA positive could be the basis for the diagnosis of an HCV infection.

Based on the above principles, this study only investigated the infectious disease reporting rate and reporting accuracy rate of HCV RNA positive cases in county-level hospitals, and the results obtained were more accurate and more convincing. The verification results showed that the HCV antibody-positive cases had a low RNA detection rate, which may be due to two main reasons. First, this phenomenon may be caused by a lack of nucleic acid detection capabilities in the hospital, and the nucleic acid detection capabilities should be prioritized in county hospitals in the future. Second, professional may fail to understand the causes of hepatitis C or not pursue further RNA testing due to cost. In the future, the cost of hepatitis C RNA testing and treatment should be included in the scope of medical insurance to reduce the financial burden of patients.

Since 2013, the National Center for STD/AIDS Prevention and Control of China CDC has strengthened training on hepatitis C case reporting for provincial-level CDCs, and provincial-level CDCs have organized secondary training in their regions. The training target was mainly county-level hospitals, which greatly improved the ability of hepatitis C diagnosis and reporting in county-level hospitals (8). At the same time, we conducted annual spot checks and verification for county-level hospitals and used

work guidance to further improve case reporting rates and report quality. The verification of the national team played a leading role. Through national supervision, the provincial-level and municipal CDCs carried out a wider range of verification and gradually improved the quality of data. By strengthening the management of hepatitis C case reports, the reporting rate of infectious diseases of hepatitis C HCV RNA positive cases in county-level hospitals in China had increased significantly from 46.83% in 2013 to 94.81% in 2018, and the accuracy rate of reports increased from 52.59% in 2013 to 96.12% in 2018.

This study was subject to some limitations. First, only county-level hospitals with nucleic acid testing capabilities were tested. Second, selection of PLADs and county-level hospitals for investigation was also arranged according to work plans rather than random sampling. Third, using work supervision to collect data and provide onsite guidance was due to convenience and might unintentionally affect the data. However, this study provided a preliminary understanding of the infectious disease reporting rate and accuracy of HCV-RNA positive cases in county-level hospitals with nucleic acid detection capabilities in China, and this data was extremely important for understanding the overall situation of hepatitis C in China and for providing a scientific basis for developing prevention strategies.

Assessing the prevalence of local hepatitis C outbreaks depends on the detection rate and positive rate of HCV antibody-positive cases, the reporting rate and the accuracy of the reports, and the number of antibody and RNA detections in medical institutions. These can effectively fill gaps in the infectious disease report data and can be used to correct reported data. In the future, all regions should strengthen the RNA detection of HCV antibody-positive cases, further improve the reporting rate and accuracy of RNA-

positive cases, and provide real epidemic data support for the prevention and treatment of hepatitis C.

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REFERENCES

1. Chinese Society of Hepatology, Chinese Medical Asso, Chinese Society of Infectious Diseases, Chinese Med. The guideline of prevention and treatment for hepatitis C: a 2015 update. *Chin J Hepatol* 2015; 23(12):906 – 23. <http://dx.doi.org/10.3760/cma.j.issn.1007-3418.2015.12.003>. (In Chinese).
2. Zhu P. Progress in the study of mixed infection of HIV and HCV and its treatment. *Chin J Clin Rational Drug Use* 2012;5(20):174 – 5. <http://dx.doi.org/10.3969/j.issn.1674-3296.2012.20.146>. (In Chinese).
3. Qin QQ, Smith MK, Wang L, Su YY, Wang LY, Guo W, et al. Hepatitis C virus infection in China: an emerging public health issue. *J Viral Hepat* 2015;22(3):238 – 44. <http://dx.doi.org/10.1111/jvh.12295>.
4. Hei FX, Ye SD, Ding GW, Pang L, Wang XC, Liu ZF. Epidemiological analysis on reported hepatitis C cases in China from 2012 to 2016. *Biomed Environ Sci* 2018;31(10):773 – 6. <http://dx.doi.org/10.3967/bes2018.103>.
5. National Health and Family Planning Commission of PRC. WS 213-2018 diagnosis for hepatitis C. *Chin J Hepatol* 2018;34(8):1619 – 21. <http://dx.doi.org/10.3969/j.issn.1001-5256.2018.08.006>. (In Chinese).
6. Freeman AJ, Dore GJ, Law MG, Thorpe M, Von Overbeck J, Lloyd AR, et al. Estimating progression to cirrhosis in chronic hepatitis C virus infection. *Hepatology* 2001;34(4):809 – 16. <http://dx.doi.org/10.1053/jhep.2001.27831>.
7. Chen SL, Morgan TR. The natural history of hepatitis C virus (HCV) infection. *Int J Med Sci* 2006;3(2):47 – 52. <http://dx.doi.org/10.7150/ijms.3.47>.
8. National Health and Family Planning Commission, National Development and Reform Commission, Ministry of Education, Ministry of Science and Technology, Ministry of Industry and Information Technology, Ministry of Public Security, et al. China viral hepatitis prevention and control plan (2017-2020). *Chin J Viral Dis* 2018;8(1): 1 – 5. <http://dx.doi.org/10.16505/j.2095-0136.2018.0001>. (In Chinese).