HEPATITIS B AND HEPATITIS C INFECTION IN WEST VIRGINA

An Evaluation of 2016 Surveillance Data

WEST VIRGINIA Department of Health & Human Resources
BUREAU FOR PUBLIC HEALTH

Office of Epidemiology and Prevention Services
350 Capitol Street, Room 125
Charleston, West Virginia 25301

Maria del Rosario, MD, MPH
Director of Surveillance
Division of Infectious Disease Epidemiology

BACKGROUND

The West Virginia Legislative Code of State Rule, title 64, series 7 mandates the reporting of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections. Health care providers (HCPs), hospitals, and clinics are required to report acute and chronic HBV as well as acute HCV patients, while laboratories are required to report HBV and HCV-related test results. The rule specifies the data elements required to be reported by HCPs, including negative or unremarkable hepatitis and liver function test results from laboratories. The rule also states that HBV and HCV infections are reportable within 24 hours and one week of notification, respectively, while outbreaks and clusters are immediately reportable.

The West Virginia Electronic Disease Surveillance System (WVEDSS), a National Electronic Disease Surveillance System (NEDSS)-based platform, is used collect, store, manage, and report notifiable infectious diseases to the Centers for Disease Control and Prevention (CDC) Nationally Notifiable Disease Surveillance System (NNDSS), including HBV and HCV. This system houses the HCV registry while the HBV registry was maintained in an Access database until 2017. The WVEDSS is web-based and is accessible to state and local public health officials who have permission to manage HBV and HCV cases. Cases entered in WVEDSS were jointly managed by local health and the West Virginia Department of Health and Human Resources (DHHR), Bureau for Public Health, Division of Infectious Disease Epidemiology (DIDE) surveillance staff. In 2015, WVEDSS began passively receiving electronic laboratory reports (ELRs) from commercial and hospital laboratories. Paper laboratory reports received were manually entered in WVEDSS, while ELRs received in WVEDSS were manually reviewed and managed by state public health. In 2016, the WVEDSS received 146,686 HBV and HCV-related test results, 86.5% of which were reported through ELR. On August 2016, the WVEDSS chronic HBV investigation form was updated to capture patient risk factor information.

Complete and timely reporting of HBV and HCV infections are important in understanding the changing epidemiology of viral hepatitis infections in West Virginia. For the past ten years, the incidence of acute HBV and acute HCV infections in West Virginia have been higher than the national average. In fact, between 2010 and 2015, the CDC reported that West Virginia had the highest annual incidence of acute hepatitis B and 2nd highest annual incidence of acute hepatitis C infection. In 2016, the incidence of acute HBV infection in the state was estimated at 14.5 cases per 100,000 persons (U.S. average=1.1 per 100,000 persons) while acute HCV infection was estimated at 7.2 cases per 100,000 persons (U.S. average = 0.9 per 100,000 persons).

Comprehensive and reliable HBV and HCV surveillance data are essential to identify cases, respond to outbreaks, and implement prevention strategies. The state had not received CDC viral hepatitis surveillance and investigation funding until 2017 when it was awarded funds through CDC's *Strengthening Surveillance in Jurisdictions with High Incidence of HCV and HBV Infections* grant to support HBV and HCV surveillance, investigation, and evaluation activities. To determine baseline and assess the quality of 2016 HBV and HCV surveillance data, an evaluation of data completeness and timeliness was conducted. The goals of this evaluation were to estimate the volume of HBV and HCV cases detected relative to the volume of patients investigated, determine the completeness and timeliness of HBV and HCV case reports, and identify areas in the investigation and reporting that can be improved. This report summarizes the results of the analysis.

METHODS

The process of investigating HBV and HCV infections are outlined on the surveillance and investigation protocol developed for each condition and are posted at www.dide.wv.gov.

Reports of HBV and HCV infections were ascertained using the 2012 surveillance case definitions established by the Council of State and Territorial Epidemiologists (CSTE) and the CDC.

The 2016 HBV and HCV surveillance data were downloaded from WVEDSS in mid-2017 following the reconciliation of surveillance data previously submitted to CDC. Case data were summarized and analyzed using Microsoft Excel 2016.

Demographic, risk factor, prevention, and outbreak information were selected to evaluate each HBV and HCV report for completeness of data, while timeframe of reporting evaluated timeliness of disease reporting to WVEDSS and CDC. Acceptable responses to each variable or question are indicated below. Percentages of cases with complete and timely data were estimated for each disease as well as for all diseases combined. These estimates were then compared with target estimates set for each variable. Target estimates for demographic and risk factor data were adapted from CDC's HBV and HCV surveillance grant.

Demographics

Completeness of demographic data was based on acceptable responses and compared against targets for each demographic variable (Table 1). Case investigations with missing or unknown response were considered incomplete. Cases residing outside of West Virginia were excluded from the analysis.

Table 1. Parameters for evaluating 2016 HBV and HCV demographic data

Demographic Data	Target % of Data Complete	Acceptable Response
Age	90	Number; WVEDSS automatically calculates difference between *PHC Add time* (date of report to WVEDSS) and date of birth
Gender	90	Male or Female
Race	70	White, Black/African American, Native Hawaiian/Pacific Islander, American Indian/Alaskan Native, and Asian
Ethnicity	70	Not Hispanic or Latino, Hispanic or Latino
County of Residence	60	Not Hispanic or Latino, Hispanic or Latino
Zip Code	60	West Virginia Zip Code

Risk Factors

Completeness of response to risk factor data was assessed for each disease by identifying questions (Table 2) applicable to each disease (Marked X). Results were summarized and compared against an established target of 70% completion. Certain risk factor questions that were not applicable (N/A) to chronic HBV and chronic HCV cases were not assessed. Case investigations with missing or unknown response were considered incomplete, unless otherwise indicated.

Table 2. Parameters for evaluating 2016 HBV and HCV risk factor data

Risk Factor	Acceptable Response	Acute HBV	Chronic HBV	Acute HCV	Chronic HCV
Patient a contact of a confirmed or suspect case of HBV or HCV	Yes, No, Unknown	X	X	X	N/A
Patient ever treated for a STD	Yes, No	X	X	X	N/A
Patient have an accidental stick or puncture with a needle or other object contaminated with blood	Yes, No	X	N/A	X	N/A
Patient employed in the medical or dental field involving direct contact with human blood	Yes, No	X	X	X	N/A
Patient employed as a public safety worker	Yes, No	X	N/A	X	N/A
Patient have any other exposure to someone's blood	Yes, No	X	N/A	X	N/A
Patient receive a tattoo	Yes, No	X	N/A	X	N/A
Patient inject drugs not prescribed by a doctor	Yes, No	X	X	X	N/A
Patient use street drugs, but did not inject	Yes, No	X	X	X	N/A
Patient have any part of their body pierced	Yes, No	X	N/A	X	N/A
Patient receive any IV infusions and/or injections in an outpatient setting	Yes, No	X	N/A	X	N/A
Patient receive blood or blood products (transfusion prior to 1992) or clotting factors prior to 1987	Yes, No	X	X	X	N/A
Patient undergo hemodialysis or long term-hemodialysis	Yes, No	X	X	X	N/A
Patient have dental work or oral surgery	Yes, No	X	N/A	X	N/A
Patient have surgery (other than oral surgery)	Yes, No	X	N/A	X	N/A
Patient hospitalized	Yes, No	X	N/A	X	N/A
Patient a resident of a long-term care facility	Yes, No	X	N/A	X	N/A
Patient incarcerated for more than 24 hours	Yes, No	X	N/A	X	N/A
Patient ever incarcerated for longer than six months	Yes, No	X	X	X	N/A

Reporting Source

Completeness of information on the reporting source was evaluated by determining the percent of cases with HCP information. A target of 50% completeness was set. In addition, DHHR's West Virginia Viral Hepatitis Surveillance Team compared the number of HCPs and laboratories reporting in 2016 with 2015 and aimed to have at least 80% reporting in 2016 compared with the previous year. A laboratory or HCP reporting multiple times was counted as one.

Prevention

Response to receipt of HBV vaccine was evaluated for acute HBV and acute HCV patients and compared against a target of 70% completeness. A response of "yes" or "no" was considered complete. DHHR's West Virginia Viral Hepatitis Surveillance Team also evaluated the percent of HBV and acute HCV patients receiving education or information from public health (public health action) to establish baseline information.

Timeliness

To evaluate timeliness of reporting, two timeframes were measured against a target of at least 70% of cases reporting within the established timeframes:

1. Timeliness of reporting from HCP to West Virginia public health: This was calculated by measuring the interval from the date the laboratory sent the report (*Laboratory Report Date*) to public health to the date the report was first entered in WVEDSS (*PHC Add Time)*. The West Virginia Reportable Disease Rule mandates HCPs to report HBV infections within 24 hours of notification, while HCV infections are reportable within one week.
2. Timeliness of reporting from West Virginia public health to CDC: This was calculated by measuring the interval from the date the report was first entered in WVEDSS (*PHC Add Time)* to the date WVEDSS sent the report to CDC's NNDSS (*1st Notification Send Date*). The recommended timeframe of reporting from WVEDSS to CDC's NNDSS was set at 30 days.

Outbreaks

An outbreak is considered when a single case of acute HBV or acute HCV infection had an invasive procedure during the incubation period and no other risk factors for hepatitis. All suspected and confirmed outbreaks are required to be reported immediately.

Reports of outbreaks or clusters were collected and stored in a Microsoft Excel database maintained by DIDE. The database was reviewed to determine the total number of confirmed outbreaks reported from each setting, the total number of confirmed outbreaks reported within the appropriate timeframe, and the total number of confirmed outbreaks with written reports (setting, duration of outbreak, number cases, attack rates, recommendations, etc.) and feedback to facilities.

Measurement

Completeness and timeliness estimates were calculated by dividing the number of cases with appropriate responses with the total number of cases for each disease, multiplied by 100.

RESULTS

In 2016, 7,652 viral HBV and HCV investigations were conducted to detect 7,069 cases (92.4% of investigations) of HBV and HCV infection (Table 3). Investigations of acute and chronic HBV and acute HCV infections were conducted by the Hepatitis B Epidemiologist and Multi-Disease Epidemiologist in coordination with local health department (LHD) staff, while the HCV Registrar solely managed chronic HCV investigations. Approximately 47% of acute HBV investigations and 59% of acute HCV investigations were ascertained as cases, compared with 97% for chronic HBV and chronic HCV reports. The high sensitivity of the surveillance system to detect chronic HBV and HCV cases is largely due to passive ELR, the primary source of information.

Table 3. Percentage of HBV and HCV investigations that were cases, West Virginia, 2016

Condition	Number of Cases	Number of Investigations	Percent of Investigations That Were Cases
Acute HBV	268	568	47.2
Chronic HBV	353	355	99.4
Acute HCV	132	223	59.2
Chronic HCV	6316	6506	97.1
Total	7,069	7,652	
Average			92.4

Demographics

An evaluation (Table 4) of the 7,069 HBV and HCV case reports revealed that almost 100% of HBV and HCV reports had information on age, gender, and county of residence, while zip code was available for 93% of cases. Information on race and ethnicity was available for at least 74% of acute and chronic HBV and acute HCV cases, all meeting the 70% target for completeness. Race and ethnicity information were not assessed for chronic HCV cases as laboratories do not routinely collect these.

Table 4. Completeness of HBV and HCV demographic data, West Virginia, 2016 (n=7,069)

Demographics	Target	Overall Completion	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6,316
	% Complete					
Age	*90*	100	100	100	100	99.9
Gender	*90*	100	100	100	100	100
Race	*70*	86	91	81	90	N/A
Ethnicity	*70*	74	78	70	78	N/A
County of Residence	*60*	100	100	100	100	100
Zip Code	*60*	93	99	99	99	93

Risk Factors

Public health staff collect risk exposure information (Table 5) from patients and/or HCPs during HBV and acute HCV case investigations. Of the 19-risk factor questions applicable to acute HBV and acute HCV cases, an average of 80% of acute HBV and 76% of acute HCV cases responded accordingly. Among chronic HBV patients, response was suboptimal at 23%. This was as expected since the chronic HBV investigation form did not collect risk factor information until late August 2016. Because of the low completeness estimates for chronic HBV cases, the overall completeness of risk factor data was 68%, slightly below the 70% target. Risk exposure information was not available for chronic HCV cases.

Table 5. Completeness of HBV and HCV risk factor data, West Virginia, 2016 (n=7,069)

Risk Factors	Target	Overall Completion	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6,316
	% Complete					
	70	68	80	23	76	N/A
Contact of a confirmed or suspect case of HBV or HCV		56	99	8	99	N/A
Ever treated for a STD		51	74	26	69	N/A
Accidental stick or puncture with a needle or other object contaminated with blood		72	73	N/A	70	N/A
Employed in the medical or dental field involving direct contact with human blood		56	82	27	79	N/A
Employed as a public safety worker		81	82	N/A	78	N/A
Any other exposure to someone's blood		72	73	N/A	71	N/A
Receive a tattoo		76	77	N/A	75	N/A
Inject drugs not prescribed by a doctor		60	88	25	84	N/A
Use street drugs, but did not inject		58	84	24	77	N/A

Have any part of their body pierced		75	76	N/A	74	N/A
Receive any IV infusions and/or injections in an outpatient setting		77	79	N/A	76	N/A
Receive blood or blood products (transfusion prior to 1992) or clotting factors prior to 1987		50	80	19	75	N/A
Undergo hemodialysis or long term-hemodialysis		54	80	27	77	N/A
Have dental work or oral surgery		76	77	N/A	73	N/A
Surgery (other than oral surgery)		76	77	N/A	75	N/A
Hospitalized		79	80	N/A	77	N/A
Resident of a long-term care facility		81	82	N/A	80	N/A
Incarcerated for >24 hours		69	71	N/A	66	N/A
Ever incarcerated for > 6 months		53	78	27	72	N/A

Reporting Source

Information on the source of test was available for 98% of cases, surpassing the 50% target for completeness (Table 6). Regarding the number of laboratories and HCPs reporting, in 2015, a combined total of 165 laboratories and HCPs reported cases of HBV and HCV. In 2016, 171 laboratories and HCPs reported, a 3.6% increase from the previous year. The result showed that the number of laboratories and HCPs reporting in 2016 far exceeded the target of 80%.

Table 6. Completeness of HBV and HCV reporting source data, West Virginia, 2016 (n=7,069)

Reporting Source	Target	Overall Completion	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6,316
	% Complete					
Testing source	*50*	98	99	99	96	100
Labs and HCP reporting	*80*	103.6				

Prevention

Responses to "*ever receive HBV vaccine"* among acute HBV and acute HCV cases did not meet the minimum target of 70%. Only 58% of cases responded "yes" or "no" to this question (Table 7), suggesting that more than 40% of patients were either unaware of their HBV vaccination status or were not interviewed. Education or information (public health action) was provided to at least 82% of HBV and acute HCV patients. Although no target was established for this activity, West Virginia will be using this data to establish a baseline target.

Table 7. Completeness of HBV and HCV prevention-related data, West Virginia, 2016 (n=7,069)

Prevention	Target	Overall Completion	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6,316
	% Complete					
Ever receive the HBV vaccine	*70*	58	68	N/A	36	N/A
Public health action	*TBD*	82	86	79	83	n/a

Timeliness of Reporting

Analysis of timeliness data revealed a wide range of reporting dates for HBV and HCV case reports. Attempts were made to accurately validate these dates. However, due to challenges associated with data validation, reporting timeframes were excluded from this analysis (Table 8). Among acute HCV cases, West Virginia found that did not meet the 70% target for timely reporting as only 44% of cases were reported within 30 days to NNDSS.

Table 8. Timeliness of HBV and HCV surveillance data reporting, West Virginia, 2016 (n=7,069)

Timeliness of Reporting	Reporting Timeframe	Target (% timely)	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6,316
Timeframe of report from HCP to WVEDSS	HBV: 24 hours, HCV: 1 week	*70*	N/A	N/A	N/A	N/A
Timeframe of report from WVEDSS to NNDSS	30 days	*70*	N/A	N/A	44	N/A

Outbreaks

In 2016, there were two suspect cases of viral hepatitis (acute HBV and acute HCV infections) outbreaks. These cases had health care exposures but no high-risk behaviors. Investigations were conducted and found that the first case had false positive HBV test results, while the second case had no identifiable mode of transmission for HCV infection. Both investigations were determined as 'not an outbreak'.

CONCLUSION

Complete, timely and accurate viral hepatitis surveillance data is essential to better understand HBV and HCV infection as well as guide disease response and prevention efforts.

The West Virginia public health system relies primarily on HCPs, facilities, and laboratories to report patients suspected or confirmed with HBV and HCV infections. In general, as with many passive surveillance systems, disease reports can be incomplete, incorrect and delayed. However, with coordinated efforts between local health and DIDE surveillance staff, West Virginia obtained substantial HBV and HCV surveillance information despite limited staffing and large volume of reports received.

This report shows that, in 2016:

1. West Virginia met the targets for completeness of demographic information. Almost 100% of key demographic information were completed while information on race and ethnicity were available for at least 70% of cases.
2. Risk exposure information was collected for most of acute HBV and acute HCV patients. However, due to changes in chronic HBV data collection methods, overall data completeness was slightly below the target. DHHR's West Virginia Viral Hepatitis Surveillance Team anticipates improved data completeness in 2017 when able to capture a full year of chronic HBV case risk factor information.
3. West Virginia identified 3.6% more HCPs reporting in 2016 compared with 2015, in part possibly due to ELR reporting.
4. Only 68% of acute HBV and 36% of acute HCV patients were aware of their HBV vaccination status. This finding emphasizes the need to educate patients about HBV vaccination. On the other hand, local public health reported that at least 79% of HBV and acute HCV patients received some type of HBV and HCV education.

5. Timeliness of reporting was difficult to analyze at this time. However, the viral hepatitis surveillance staff are working with the DIDE Programmer Analyst to understand and tease out the problem. Further discussions will be held to identify areas for improvement to efficiently collect data.

There were several limitations identified in this report that could have influenced the results. These are:

- Risk exposure information were self-reported by patients and sometimes not verified with health-related records.
- Chronic HBV risk factor information were collected later in the year (August 2016).
- Different data collection methods were employed to collect patient information (medical records abstraction, phone interviews, face-to-face interviews, or by mailing the investigation forms for patients or HCPs to complete) and can have varying outcomes.
- Risk exposure questions and responses can be subject to interpretation by both the interviewer and the patient and these were not validated.
- Public health action implies pro-active education of patients by local health staff. Some LHDs, however, consider distribution of disease information sheets and physician education as public health action.
- Disease outbreaks were often detected via reports from HCPs, the public, or through systematic review of surveillance data. Zero report of outbreaks does not necessarily translate to absence of outbreaks.

This report highlights the need to share information with public health partners to inform about the quality of surveillance. Sharing of information can uncover training needs of public health staff as well as educational needs of HCPs.

In conclusion, this report also shows that quality surveillance data can be achieved despite challenges and limitations. West Virginia accomplished this by clarifying responsibilities and coordinating public health and HCP activities outlined on the HBV and HCV surveillance and investigations protocols. Dedicated viral hepatitis surveillance (DIDE) staff conducted meticulous review and management of investigations and reports by validating patient addresses using different techniques and routinely de-duplicating reports. Local health staff tracked patients and contacts creatively through social media. The open and ongoing communication and good rapport between public health officials and HCPs remains key to obtaining quality surveillance data.

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Contributors:
Ashley Simmons, MS
Hepatitis B Epidemiologist
DIDE, DHHR

Clarissa Smallridge
Hepatitis C Registrar
DIDE, DHHR

Leena Anil, PhD
Former Multi-Disease Epidemiologist
DIDE, DHHR

Maria del Rosario, MD, MPH
Director of Surveillance
DIDE, DHHR

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Brett Armstrong
Programmer Analyst
DIDE, DHHR

Melissa Scott, RN
Outbreak Nurse
DIDE, DHHR

Public Health Staff including Regional Epidemiologists
West Virginia LHDs