WEST VIRGINIA VIRAL HEPATITIS B AND C SURVEILLANCE

A surveillance overview of the incidence and risk factors associated with cases of viral hepatitis B and C from 2012-2015 in West Virginia

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West Virginia Viral Hepatitis B and C Surveillance 2012-2015

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Abbreviations

ACIP: American College of Immunization Professionals
AHBVPP: Adult Hepatitis B Vaccination Pilot Project
AI/AN: American Indian Alaskan Native
BPH: Bureau for Public Health
CDC: The Centers for Disease Control
CCHAC: Coalition of Correctional Health Authorities American Correctional Association
CSTE: Council of State and Territorial Epidemiologists
DIS: Division of Immunization Services
DIDE: Division of Infectious Disease Epidemiology
ELR: Electronic Lab Report
HBV: Hepatitis B Virus
HBIG: Hepatitis B Immune Globulin
HCV: Hepatitis C Virus
HIV: Human Immunodeficiency Virus
IDU: Intravenous Drug Use
IG: Immune Globulin
LHD: Local Health Department
OEPS: Office of Epidemiology and Prevention Services
NAT: Nucleic Acid Amplification Test
NEDSS: National Electronic Disease Surveillance System
NETSS: National Electronic Telecommunications System for Surveillance
NBS: National Electronic Disease Surveillance Base System
RIBA: Recombinant Immunoblot Assay
SAP: Syringe Access Program
STD: Sexually Transmitted Disease
U.S.: United States
WVVHPC: West Virginia Viral Hepatitis Prevention Coordinator
WVDHHR: West Virginia Department for Health and Human Resources
WVEDSS: West Virginia Electronic Disease Surveillance System

Definitions

Asymptomatic: Not exhibiting or involving symptoms.
Baby Boomers: People born during the demographic post–World War II baby boom; between the years 1946 and 1964.
Case Definition: A set of uniform criteria used to define a disease for public health surveillance. Case definitions enable public health to classify and count cases consistently across reporting jurisdictions, and should not be used by healthcare providers to determine how to meet an individual patient's health needs or to diagnose.
Chronic Liver Disease: A disease process of the liver that involves a course of progressive liver destruction.
Contact of a HBV and/or HCV Case: Someone who has/had known or suspected contact with blood or bodily fluids of someone known or suspected to have HBV or HCV.
Epidemiologist: Someone who studies and analyzes the patterns, causes, and effects of health and disease conditions in defined populations.
Harm Reduction: Public health activities designed to reduce the harmful consequences associated with human behaviors, both legal and illegal (i.e. Supplying sterile syringes and equipment to IDU to reduce the risk of acquiring blood-borne pathogens via the reuse of contaminated drug equipment).
Healthcare Associated Infection: An infection acquired within a healthcare setting while receiving medical care.
HBsAg: The hepatitis B surface antigen is a laboratory marker that indicates current HBV infection.
HBcIGM: The hepatitis B core antibody immunoglobulin is a laboratory marker that indicates a recent HBV infection.
High Risk Drug Activity: Engaging in illegal drug activity that increases the risk of acquiring HBV, HCV or HIV.
Heroin: An opioid painkiller that is used as a recreational drug for its euphoric effects.
Incidence: The rate of new or newly diagnosed cases of disease.
Index patient: The primary case, or the first case of a condition or syndrome in relation to an outbreak.
Linkage to Care: Connecting someone infected with HBV or HCV to an infectious disease specialist for further disease monitoring, care, and treatment.
Local Health Department: The health department for a specific West Virginia county.
Needle stick accident: An accidental needle puncture occurring while providing health care to a patient.
Opioid: Substances that act on opioid receptors to produce morphine like effects. Most often used medically to relieve pain.
Onset Year: The year in which symptoms of the disease began.
Outbreak: A sudden increase in occurrence of a disease in a particular time and place**.**
Prevalence: The proportion of a population found to have a condition or disease. It is arrived at by comparing the number of people found to have the condition with the total number of people being studied.
Rate: Also known as crude or adjusted rates are calculated by dividing the number of events of interest by the population for a given time period.
Risk Factor: A condition, behavior, or other factor that increases risk.
Substance abuse treatment facility: Facility aimed towards detoxing and rehabilitating drug abusers.
Surveillance The monitoring of the behavior, activities, or other changing information, usually of people, for the purpose of influencing, managing, directing, or protecting them.
Symptomatic: Exhibiting or involving symptoms (i.e. nausea, right upper quadrant pain, or jaundice).
Vertical Transmission: Disease transmission from mother to child during birth.
WV Code 16-3-1; 64 CSR 7: Reportable disease rule that mandates all cases and positive labs of HBV be reported within 1 day to the county health department of the patients' residence for HBV, and that all positive labs or cases of HCV be reported to the state health department within 1 week.

Overview of West Virginia

West Virginia is a state located entirely within the Appalachian Region of the southern United States. West Virginia was admitted to the Union as a state on June 20, 1863, and was an important Civil War border state. West Virginia's largest city is Charleston, its capitol.

The state of West Virginia is known for its mountains, rolling hills, and its coal mining trade. West Virginia is almost completely mountainous, giving meaning to the nickname "The Mountain State" and the motto Montani Semper Liberi ("Mountaineers are always free"). The average elevation of West Virginia is 1,500 feet (460 m) above sea level, which is the highest of any U.S. state east of the Mississippi River.

West Virginia has a total of 55 counties, and is bordered by five states which include: Virginia, Pennsylvania, Ohio, Maryland and Kentucky. In 2015, the estimated population of West Virginia was 1,844,128, making it the 38th most populous state in the United States. The state's population and gender reflects national averages of an equal proportion of males to females. The median age of West Virginians in 2015 was 40 years old, and the population is predominantly white non-Hispanic (90%).

Hepatitis B and hepatitis C became reportable conditions by law in West Virginia in 1999 per the West Virginia reportable disease rule, WV Code 16-3-1; 64 CSR 7. West Virginia began conducting hepatitis B & hepatitis C surveillance in 1994, and hepatitis B and hepatitis C registries were established in 2002. Incident cases of hepatitis B and hepatitis C are tracked by the West Virginia Office of Epidemiology and Prevention Services, which is a part of the West Virginia Department of Health and Human Resources, Bureau for Public Health, whose mission is to monitor the occurrence of diseases, provide services, interventions, and public education.

Introduction

Hepatitis B and hepatitis C are severe liver infections caused by the hepatitis B virus (HBV) and the hepatitis C virus (HCV), respectively. In comparison to national rates, in 2015, West Virginia reported the highest incidence of acute HBV infection at 14.7 per 100,000 population and the second highest rate of HCV infection at 3.4 per 100,000 population in the United States (US). Since 2010, the incidence of acute HBV and acute HCV has increased 213% and 209%, respectively.

Both HBV and HCV infection can cause acute (short-term) or chronic (lifelong) infection. Symptoms of acute HBV and HCV infections are analogous and can include malaise, anorexia, abdominal pain, jaundice, nausea, vomiting, diarrhea and/or dark urine. Symptoms of HBV infection can take 42 to 180 days (6 weeks to 6 months) and HCV infection can take 14 to 180 days (2 weeks to 6 months) to display. Patients who are chronically infected with HBV and/or HCV are frequently asymptomatic, but can present with symptoms similar to an acute infection.

Most individuals who are chronically infected with HBV and/or HCV can remain asymptomatic for as long as 20 to 30 years. It is estimated that 15%–25% of those chronically infected with HBV will develop health complications, including liver damage, liver failure and liver cancer. It is estimated that nearly 2,000 - 4,000 people die each year from HBV related liver illness. Chronic HCV infection is the most common chronic blood-borne infection in the United States with an estimated 3.2 million chronically infected individuals. HCV infection is most prevalent among "baby boomers," or those born between 1945 - 1965, the majority of whom were likely infected during the 1970s and 1980s. The high prevalence of HCV infection in this birth cohort is largely attributed to exposures that occurred during this period of increased incidence. Many of those exposures were thought to be associated with illicit drug use or blood transfusions.

HBV and HCV are transmitted through exposure to infected blood or body fluids. In the United States, common risk factors for infection include injection drug use (IDU), non-injection street drug use, sexual transmission and incarceration. Body piercing and tattooing are other potential risk factors for transmission if contaminated equipment or supplies are used. Sharing of personal items (i.e. razor, toothbrush) contaminated with HBV or HCV-infected blood can also be potential sources of infection. HBV infection is a sexually transmitted disease; however, HCV infection is less commonly transmitted sexually, unless there is high risk sexual activity. Healthcare acquired HBV or HCV infection can occur if there are lapses in infection control during medical care and an individual is exposed to fomites or medication contaminated with HBV or HCV infected blood or body fluids.

HBV infection is a vaccine preventable disease. A dose of HBV vaccine is recommended at birth, 2 months of age and 6 months of age, to provide immunity to HBV (CDC, 1991). Hepatitis B Immune Globulin (HBIG) is effective for post exposure prophylaxis. It can prevent transmission of HBV if given within 24 hours of birth for infants born to HBV infected mothers to prevent perinatal transmission, within 2 weeks of contact for sexual and household contact exposure to HBV, and within one week for direct blood exposure to HBV, such as needle sticks or the shared use of syringes associated with IDU. Currently, there is no vaccine available for HCV, and the prevention of HCV infection with immunoglobulin (IG) is not effective for post-exposure prophylaxis.

Methodology

The West Virginia Department of Health and Human Resources (WVDHHR), Bureau for Public Health (BPH), Office of Epidemiology and Prevention Services (OEPS), Division of Infectious Disease Epidemiology (DIDE)

requires health care providers, clinical facilities, and laboratories to report any positive HBV laboratory results to the local health department of the county of residence of the patient within 1 day of diagnosis for HBV. The WV Code requires reporting within one week of diagnosis to the state health department (WV Code 16-3-1; 64 CSR 7) for HCV positive results. Any suspected healthcare-associated transmission of HBV or HCV is required to be reported immediately to the DIDE. Any single case of health care transmitted HBV or HCV is considered to be an outbreak. The West Virginia Code enables the WVDHHR to identify cases of HBV and HCV and initiate control measures while collecting data for surveillance. A case is created in the West Virginia Electronic Disease Surveillance System (WVEDSS) for all new HBV or HCV positive laboratory results indicating a current HBV or HCV infection. Following the creation of a case, this case is then investigated and ascertained using the CDC/CSTE case definitions for acute and chronic HBV and HCV.

WVEDSS uses the National Electronic Disease Surveillance System (NEDSS) to electronically communicate communicable disease reports to the Centers for Disease Control (CDC). Notifiable conditions are electronically entered into the NEDSS system and selected users edit and complete the disease investigation. Prior to 2012, chronic HBV and HCV cases were entered into an Access database (former hepatitis registries). The WVEDSS then moved to a newer NEDSS Base System (NBS) in 2012. Before using NBS, West Virginia used different proprietary software for disease reporting. In 2012, West Virginia began entering chronic HBV and HCV cases in WVEDSS and ceased data entry in previously maintained registries. Due to a change in data systems in West Virginia in 2012, some cases of past/present HCV have already been reported to public health in years prior to 2012. Therefore, past/present HCV figures represent prevalence. In January 2015, West Virginia implemented electronic laboratory reporting (ELR) and began receiving ELRs from commercial and hospital laboratories.

The HBV and/or HCV cases are classified and reported to the CDC. The data represented in this report was extracted from WVEDSS on May 31, 2016. The data was filtered based on year of report and, using the 2012-2015 morbidity and mortality weekly report (MMWR) year, reporting week 1 through week 52 between January 1, 2012 and January 2, 2016. Data was exported from WVEDSS to Microsoft Excel version 2010 and then reviewed for accuracy. Cases that did not meet the 2012 Council for State and Territorial Epidemiologists (CSTE) case definitions and were classified as “not a case” were excluded.

West Virginia has an estimated population of 1,844,128 per the 2015 U.S. census data, which was used for 2015 rate calculations. Census data for 2010 (population of 1,852,994) was used for rate calculation for previous years. The HBV and HCV registries were the surveillance systems utilized until December 2011. Beginning in 2012, all positive laboratories for HBV and HCV were entered into WVEDSS. To maintain incidence of chronic HBV, older registries prior to system transition were maintained through Microsoft Access and Microsoft Excel and are checked for past history of HBV infection prior to beginning a new HBV investigation in WVEDSS. Due to resource limitations with HCV surveillance, this report includes some laboratory reports of persons who were HCV-positive prior to 2012. Therefore, the rates of past or present HCV (chronic HCV) infection provided in this report are not by incidence, but by year of report.

Case Definition - Hepatitis B

Case definitions for HBV include HBV acute “confirmed,” HBV acute “not a case,” HBV chronic “confirmed,” and HBV chronic “probable.” The 2012 CSTE case definitions of acute and chronic HBV were used to classify each case of HBV reported to DIDE from 2012 - 2015. A case of acute confirmed HBV must present with the appropriate laboratory markers that indicate a recent infection with the HBV (HBsAg, and anti-HBc-IgM *if done*). The case must also display a *sudden* onset of symptoms that may include nausea, vomiting, malaise, dark urine, and right upper quadrant pain, and experience jaundice *or* elevated liver enzymes (>100 IU/mL). A case with acute HBV laboratory markers that did not meet the clinical criteria of the case definition for acute

"confirmed" HBV as defined by CTSE was considered acute "not a case." By CSTE case definition, a "confirmed" case of chronic HBV must present with positive hepatitis B laboratory markers, and a negative result for the anti-HBc-IgM. These two serological markers or a positive HBV serology result obtained six months following a prior HBV positive result also met the CSTE case definition of chronic "confirmed" HBV. A case was considered to be chronic "probable" when there was a single positive laboratory result and the case did not meet the 2012 CSTE case definitions for acute or chronic HBV.

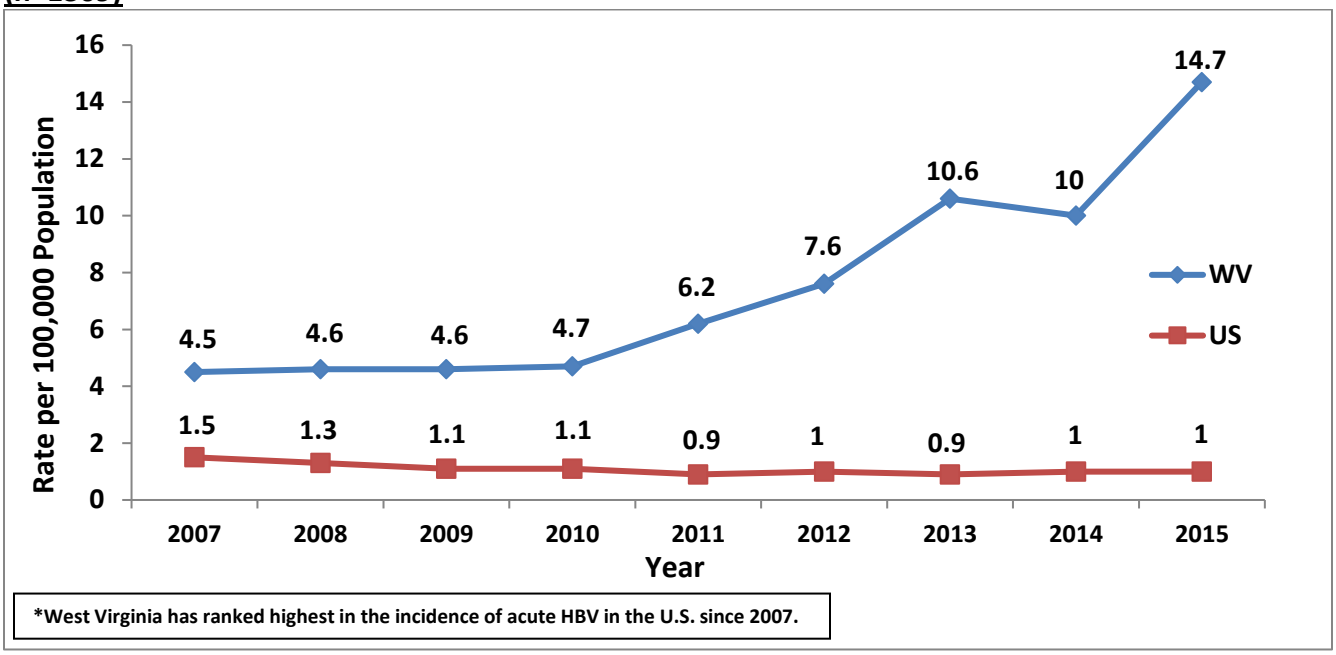
Case Definition - Hepatitis C

Hepatitis C cases were classified as hepatitis C acute "confirmed," hepatitis C "not a case," hepatitis C past or present "confirmed," hepatitis C past or present "probable" and hepatitis C past or present "not a case." The 2012 CSTE case definitions of acute and past or present hepatitis C were used to classify each case of hepatitis C reported to DIDE.

The 2012 case definition for acute hepatitis C infection includes both clinical presentation and laboratory criteria for diagnosis. An acute illness has a discrete onset of any sign or symptom consistent with acute viral hepatitis, and either jaundice, or elevated ALT levels greater than 400. However, a clinical presentation is not needed when there is a documented negative hepatitis C virus antibody test result followed within 6 months by a positive test result; this represents a recent hepatitis C infection. A case of acute confirmed hepatitis C must present with the laboratory results, such as antibodies to hepatitis C virus screening-test-positive with a signal to cut-off ratio predictive of a true positive result or positive Nucleic Acid Test (NAT) for hepatitis virus RNA (including qualitative, quantitative or genotype testing) or positive Hepatitis C Virus Recombinant Immunoblot Assay (RIBA). A confirmed case is a case that meets the clinical case definition and is laboratory confirmed, and is *not* known to have chronic hepatitis C. The case definition for chronic hepatitis C does not include clinical symptoms. Laboratory criteria for hepatitis C past or present case definition are similar to that of acute hepatitis C. A confirmed case is a case that is laboratory confirmed and does not meet the case definition for acute hepatitis C. A probable case is a case that does not meet the case definition for acute hepatitis C, and is anti-HCV repeat reactive by EIA, and has ALT values above the upper limit of normal. In this case, the anti-HCV reactive result has not been verified by an additional more specific assay or the signal to cut-off ratio is unknown.

Results - Hepatitis B

Figure 1. Incidence of Acute HBV Cases by Year of Report, West Virginia and the U.S., 2007 – 2015 (n=1309)



In 2015, 272 cases of acute HBV were identified in West Virginia. The incidence of acute HBV infection in 2015 was 14.7 per every 100,000 West Virginia residents, nearly 14 times the national average (Figure 1).

Figure 2. Incidence of Acute Confirmed HBV Cases by County of Residence, West Virginia, 2012 (n=129)

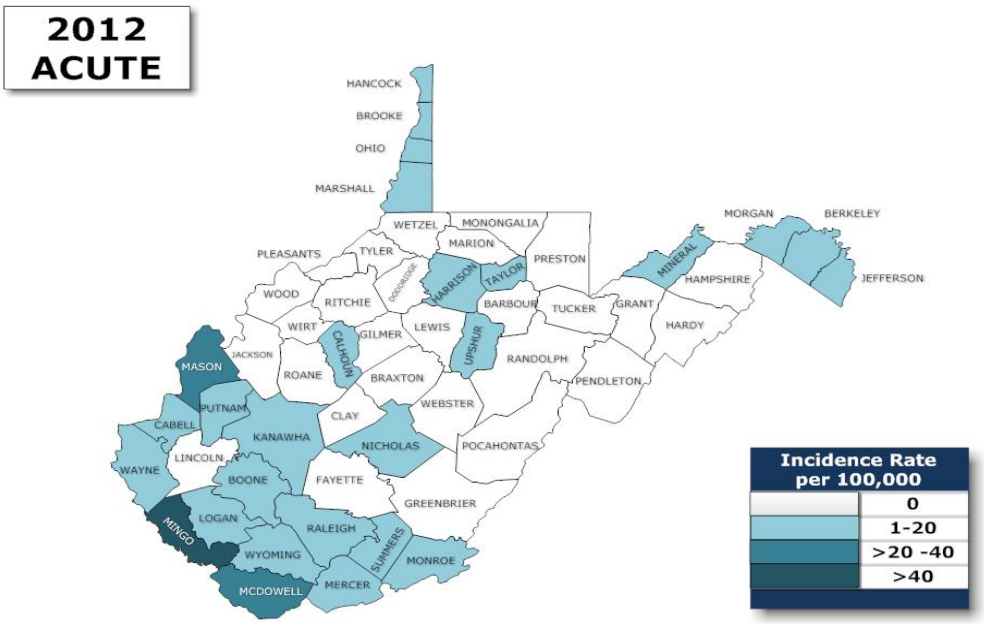


Figure 2 examines the rate of acute confirmed HBV infection by the patient's county of residence in West Virginia in 2012. Most cases were from southern and urban areas. The highest incidence of HBV infection was noted among residents of Mingo and Mason counties.

Figure 3. Incidence of Acute Confirmed HBV Cases by County of Residence, West Virginia, 2013 (n=195)

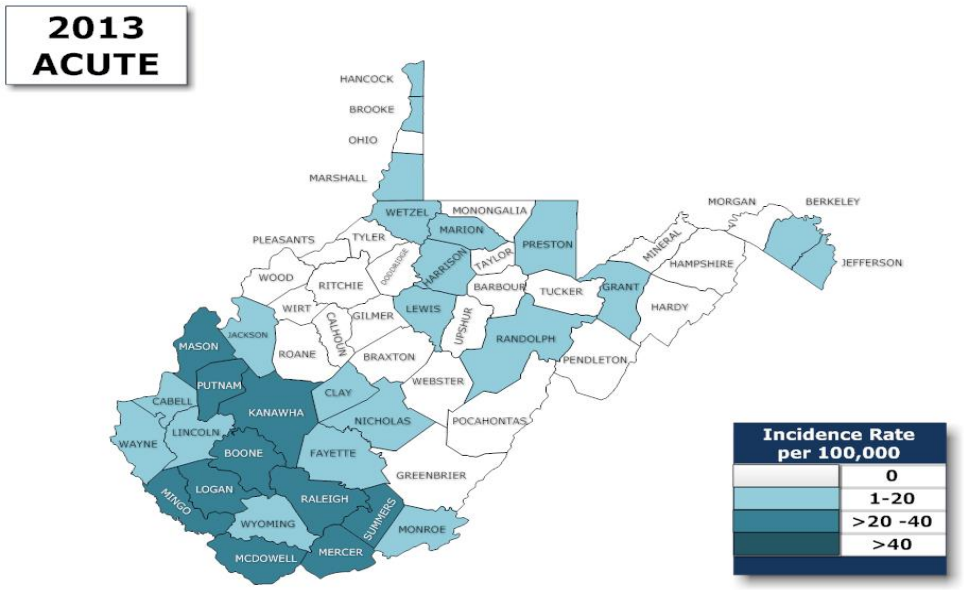


Figure 3 displays the rate of acute confirmed HBV cases by county in West Virginia in 2013. The highest areas of incidence were reported in Mingo, Summers and Boone counties, which all had a rate greater than 32.5 per 100,000 population.

Figure 4. Incidence of Acute Confirmed HBV Cases by County of Residence – West Virginia, 2014 (n=186)

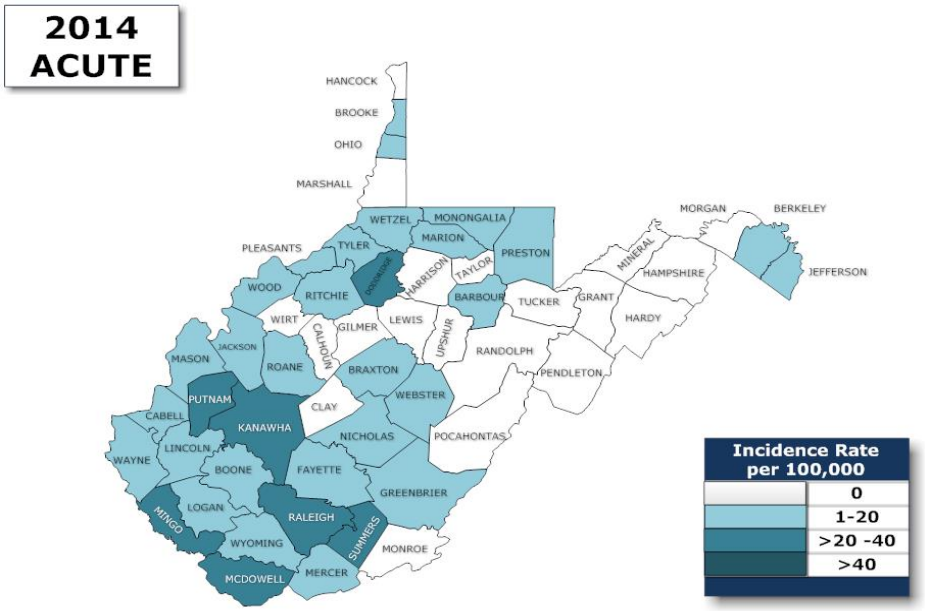


Figure 4 displays the rate of acute confirmed HBV cases in West Virginia in 2014. The highest incidence was mostly in metropolitan areas and southern West Virginia. The counties with the highest rate of acute infection include Doddridge, McDowell and Mingo counties which reported rates of ≥30 per 100,000.

Figure 5. Incidence of Acute Confirmed HBV Cases by County of Residence – West Virginia, 2015 (n=272)

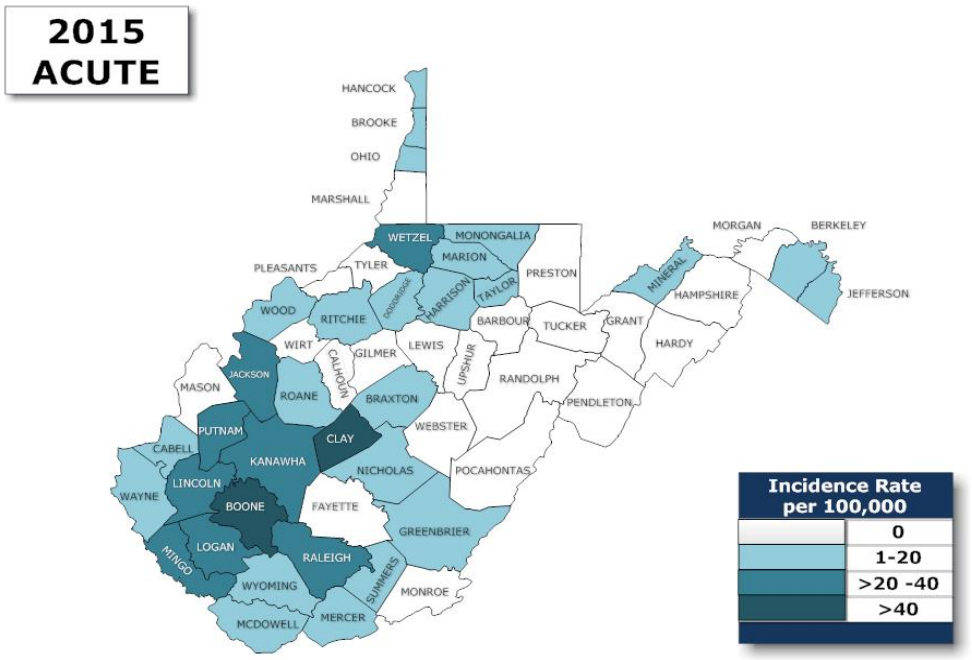


Figure 5 displays the rate of acute confirmed HBV by county in West Virginia in 2015. The highest incidence was in Clay and Boone counties, reporting rates greater than 60 per 100,000 residents.

Figure 6. Distribution of Acute HBV Cases by Age Group, West Virginia 2012-2015 (n=789)

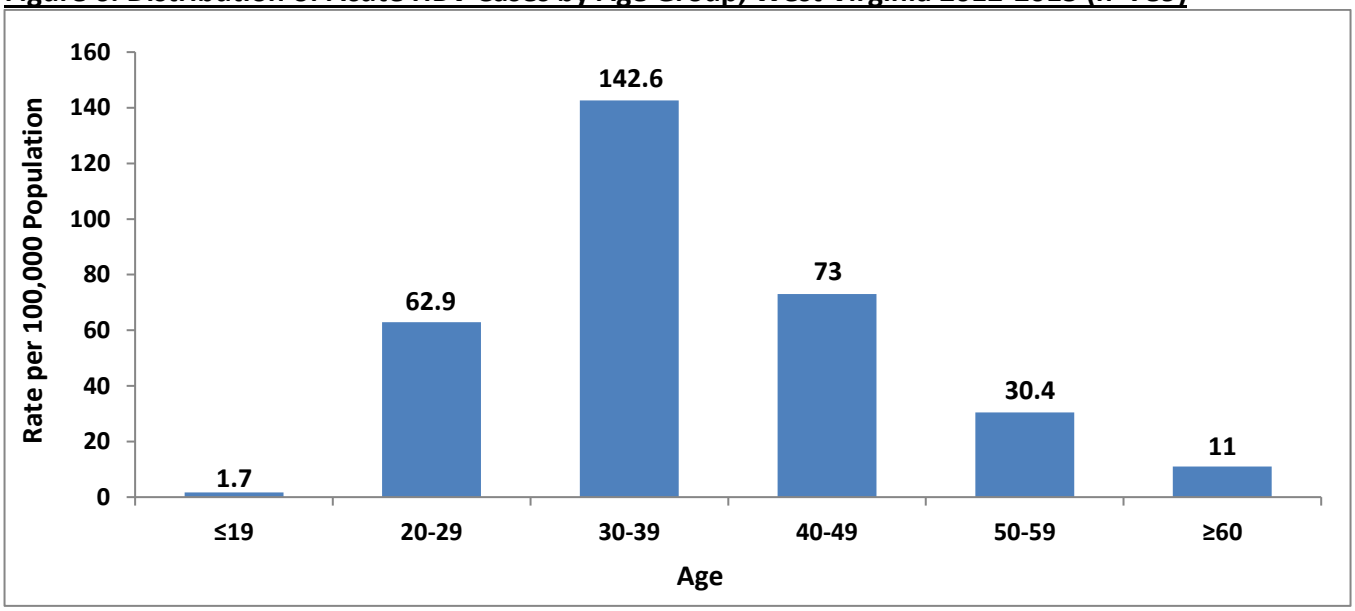


Figure 6 shows the distribution of acute HBV by age among cases reported between 2012 -2015. The largest volume of acute HBV cases were the 30-39 years age group, followed by the 40-49 age group.

Figure 7. Rate of Acute HBV Cases by Age and Gender, West Virginia 2012-2015 (n=789)

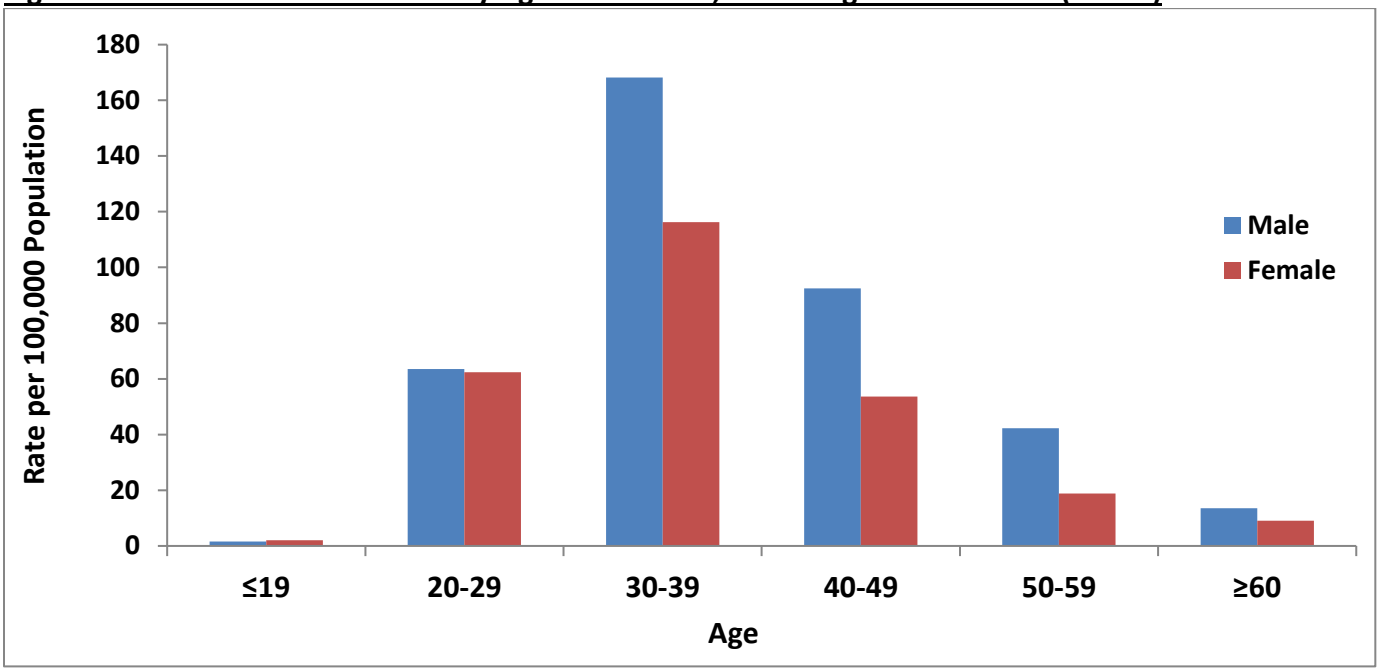


Figure 7 represents the incidence of acute HBV cases in West Virginia, by age and gender, in increments of ten years. The highest incidence of acute HBV is among males aged 30-39, followed by females aged 30-39.

Figure 8. Distribution of Acute HBV Cases by Age and Onset Year, West Virginia 2012-2015 (n=789)

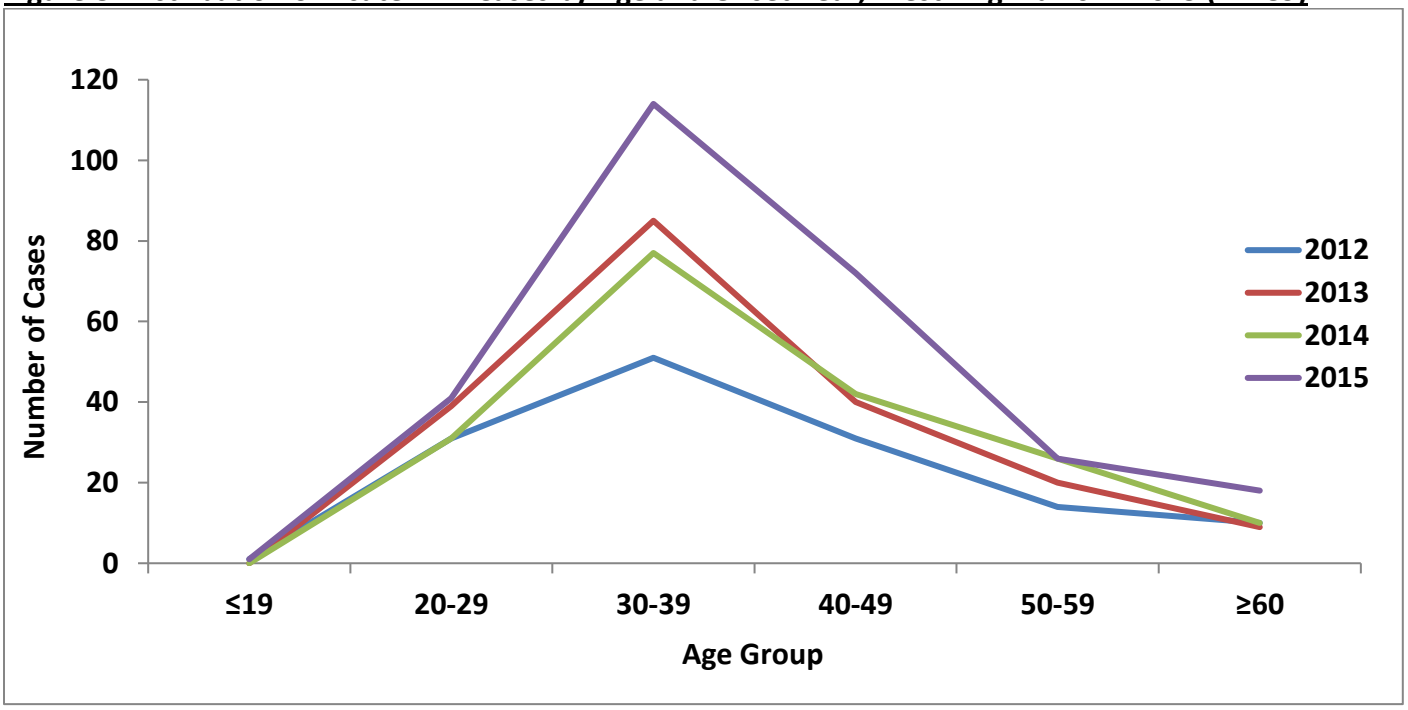


Figure 8 shows the trend of acute HBV cases. Each year, from 2012-2015 there has been an increase of acute HBV cases reported among those 30-39 years of age.

Figure 9. Percentage of Acute HBV Cases by Race, West Virginia, Onset Year 2012-2015 (n=789)

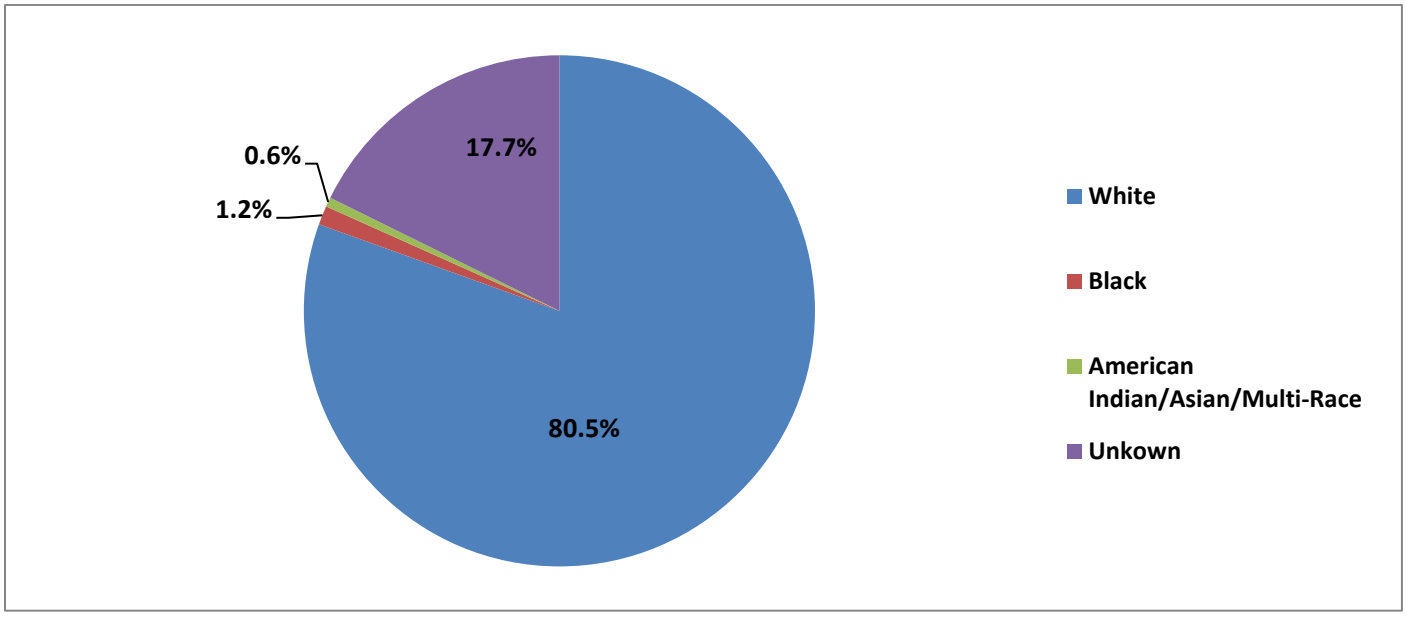


Figure 9 demonstrates that West Virginia's population is predominantly white non-Hispanic. This is reflected in the large proportion (80.5%) of acute HBV cases that report their race as white non-Hispanic.

Figure 10. Risk Factors by Gender of Acute Cases of HBV in West Virginia, 2012 (n=129)

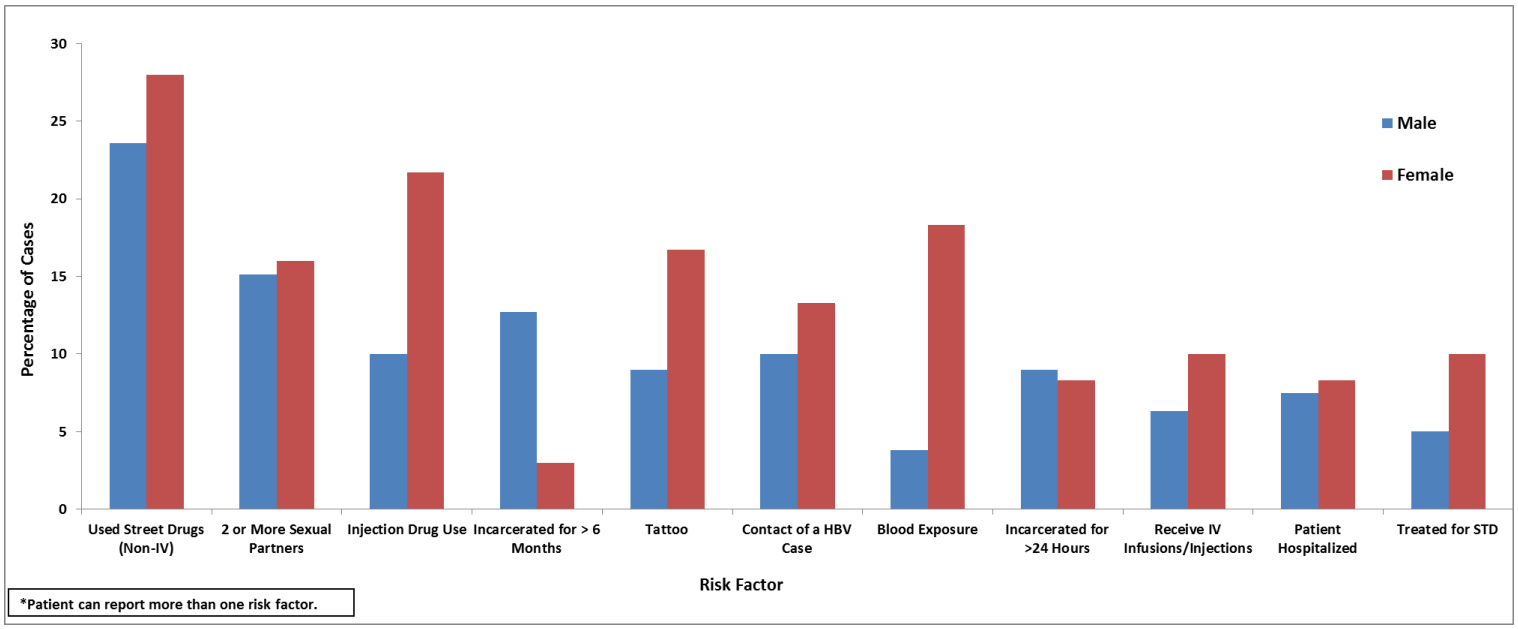


Figure 10 displays the reported interview responses, by gender, among acute cases of HBV in 2012. The use of street drugs, multiple sexual partners and injection drug use were the most commonly reported risk factors among cases of acute HBV in 2012.

Figure 11. Risk Factors by Gender of Acute Cases of HBV in West Virginia, 2013 (n=195)

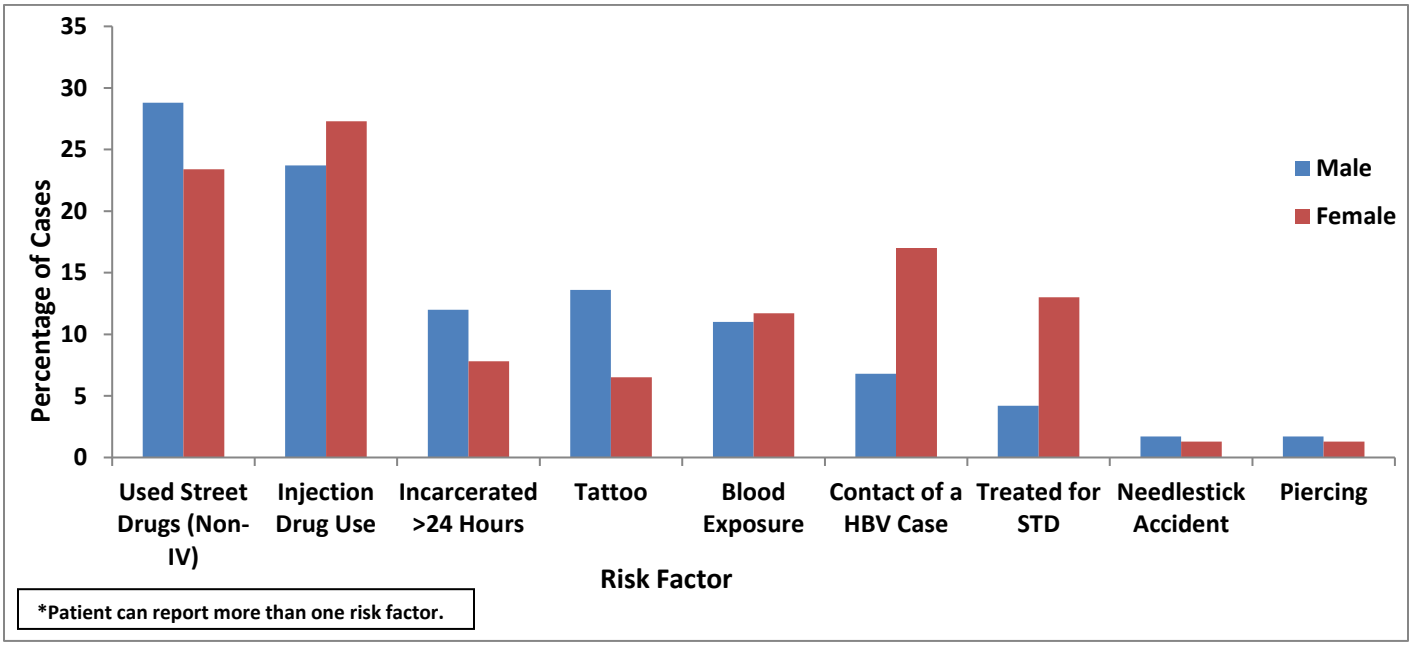


Figure 11 illustrates the patient-reported interview responses, by gender, among acute cases of HBV in 2013. The use of street drugs (Non-IV) and injection drug use were the risk factors reported from the majority of acute HBV cases in 2013.

Figure 12. Risk Factors by Gender of Acute Cases of HBV in West Virginia, 2014 (n=186)

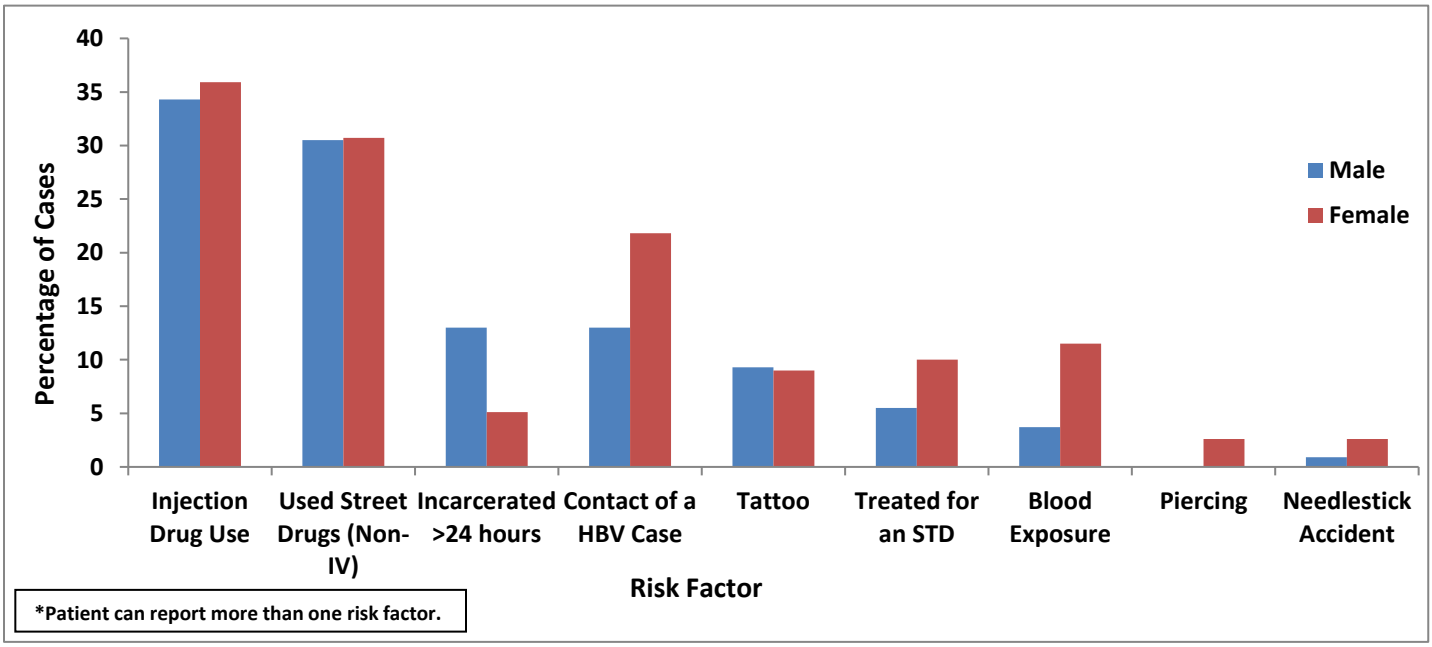


Figure 12 displays the reported interview responses, organized by gender, among acute cases of HBV in 2014. Most cases reported some form of illegal drug activity.

Figure 13. Risk Factors by Gender of Acute Cases of Hepatitis B in West Virginia, 2015 (n=272)

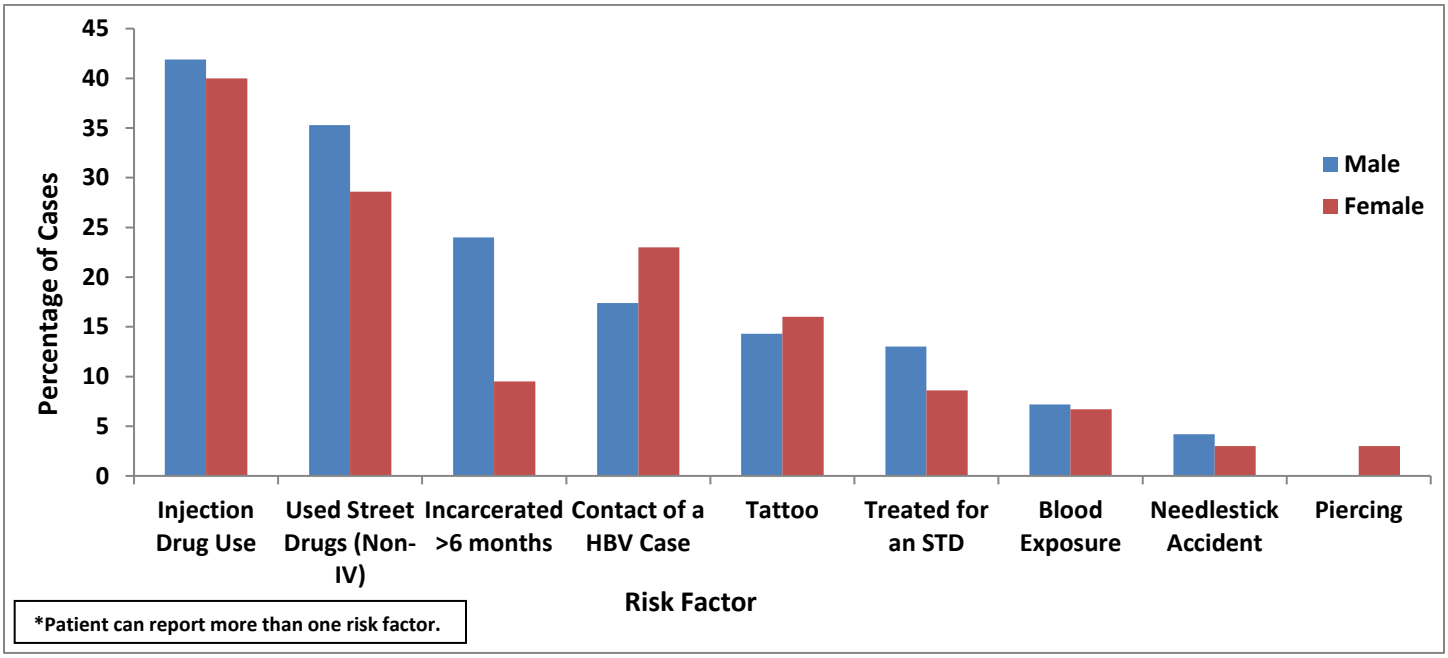


Figure 13 demonstrates the risk factors obtained from cases of acute confirmed hepatitis B during local health interview, organized by gender. Overall, both males and females reported injection drug use and street drug use more than any other risk factor.

Figure 14. Risk Factors by Age Among Acute Cases of HBV in West Virginia, 2015 (n=272)

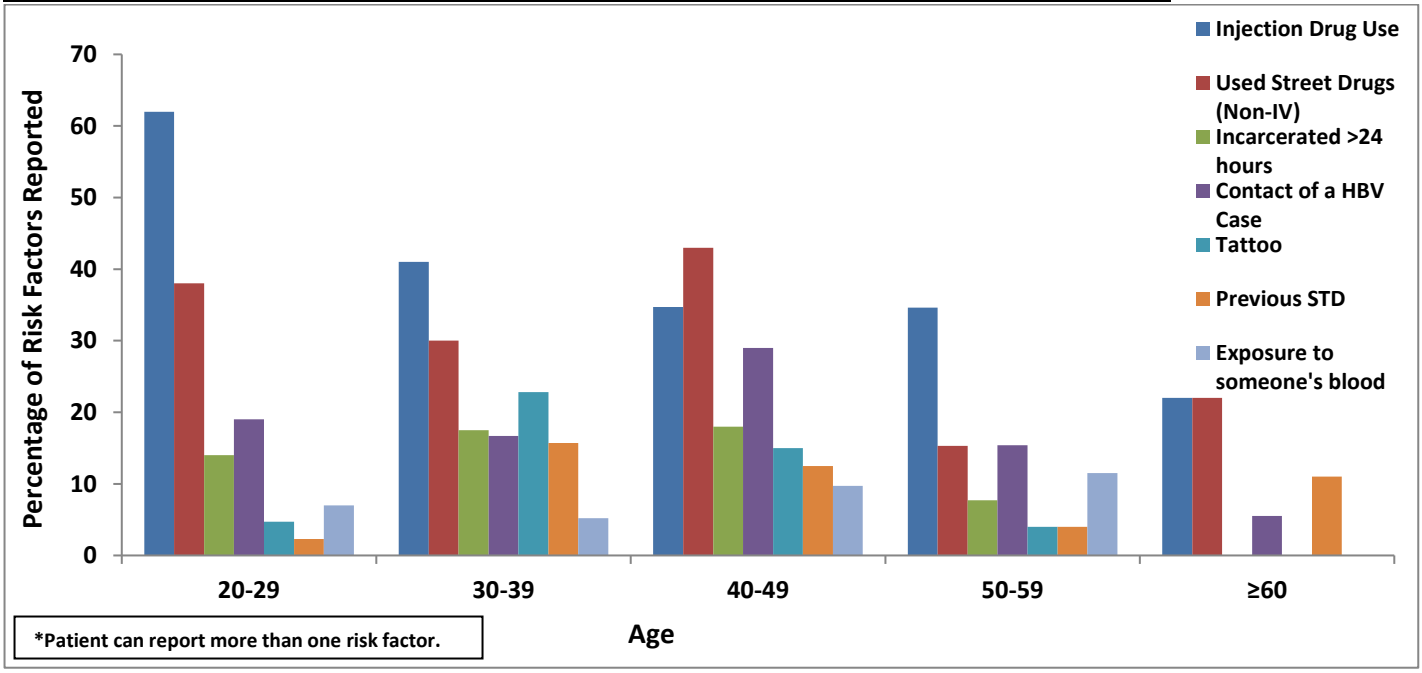


Figure 14 displays the self-reported risk factors by age group of acute hepatitis B cases during case interview. Among those aged 20-29, 62% of cases reported injection drug use as a risk factor.

Figure 15. The Rate of Chronic HBV in West Virginia, by Year of Report, 2007 - 2015 (n=1,183)*

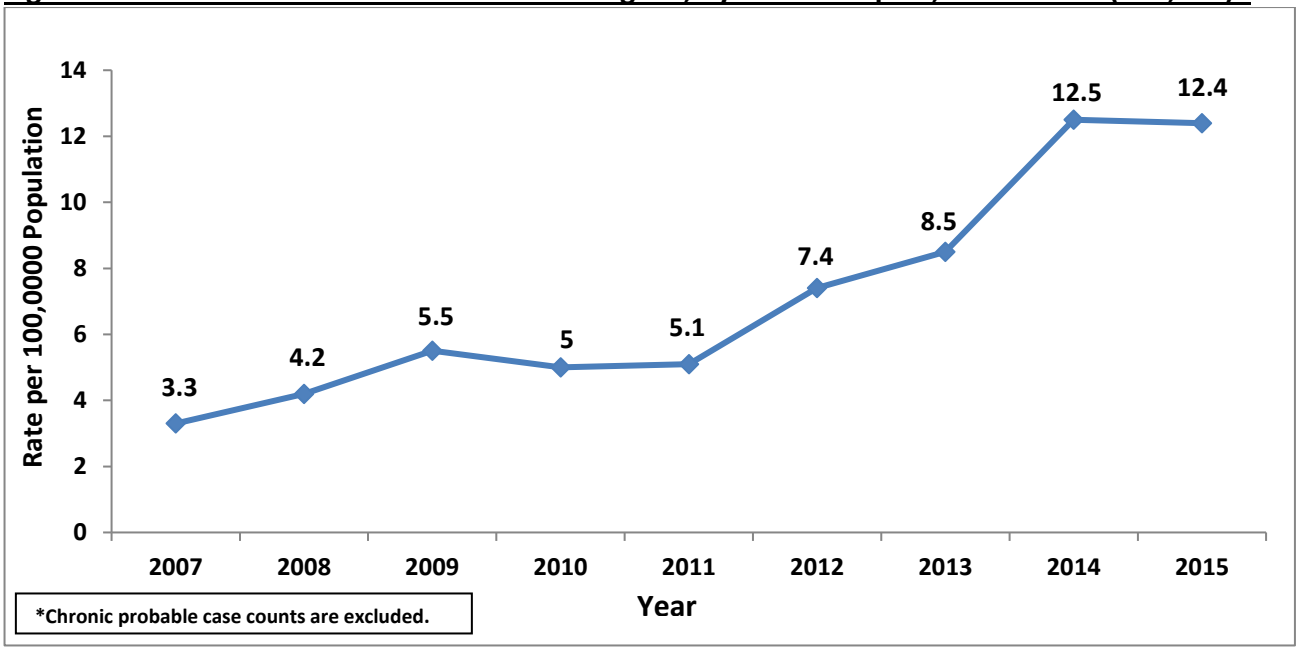


Figure 15 illustrates the rate of chronic HBV in West Virginia. The rate of chronic HBV has increased by 275% since 2007.

Figure 16. Rate of Chronic HBV in West Virginia, by County in 2012 - 2015 (n=755)

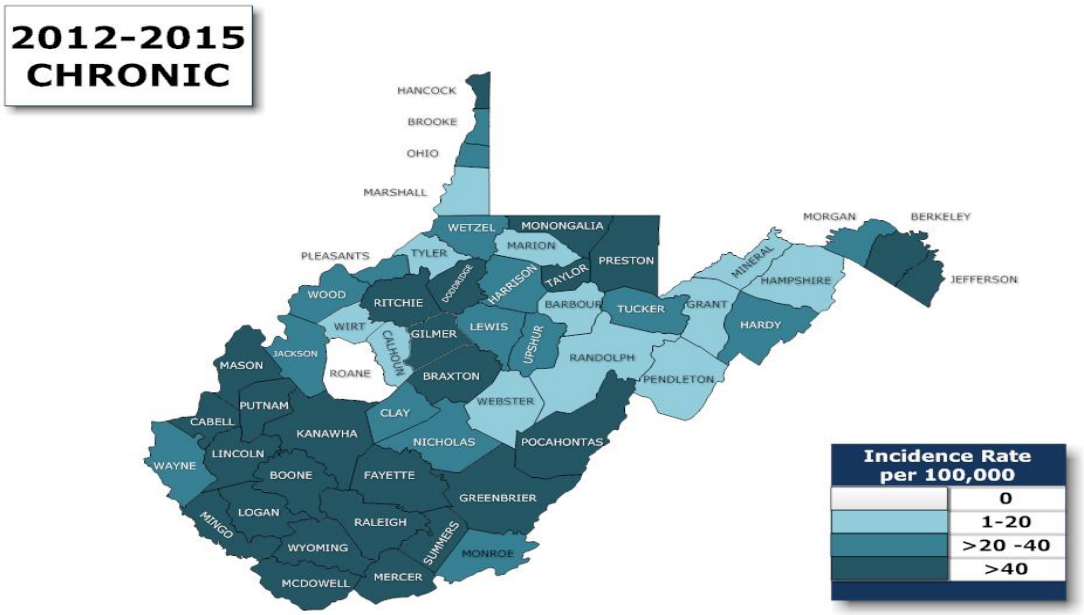


Figure 16 illustrates that from 2012-2015, the highest rates of chronic HBV infection were in southern and urban areas of West Virginia. McDowell, Mercer, Summers, Wyoming, and Raleigh counties all reported rates greater than 100 people chronically infected per every 100,000 residents.

Figure 17. Distribution of Chronic HBV Cases by Gender, West Virginia, Year of Report 2012-2015 (n=755)*

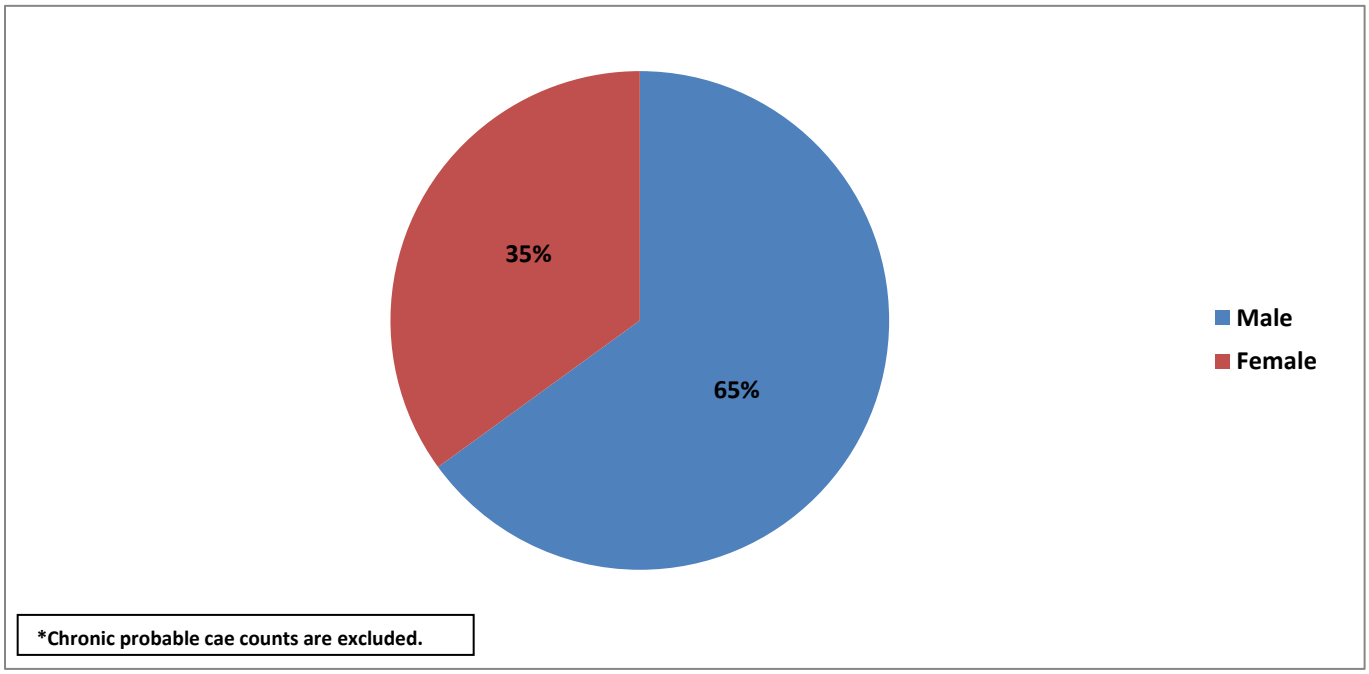


Figure 17 displays the distribution of chronic HBV cases by gender. More males were reported from 2012-2015 with chronic HBV than females.

Figure 18. Distribution of Chronic HBV Cases by Race, West Virginia, Onset Year 2012-2015 (n=755)*

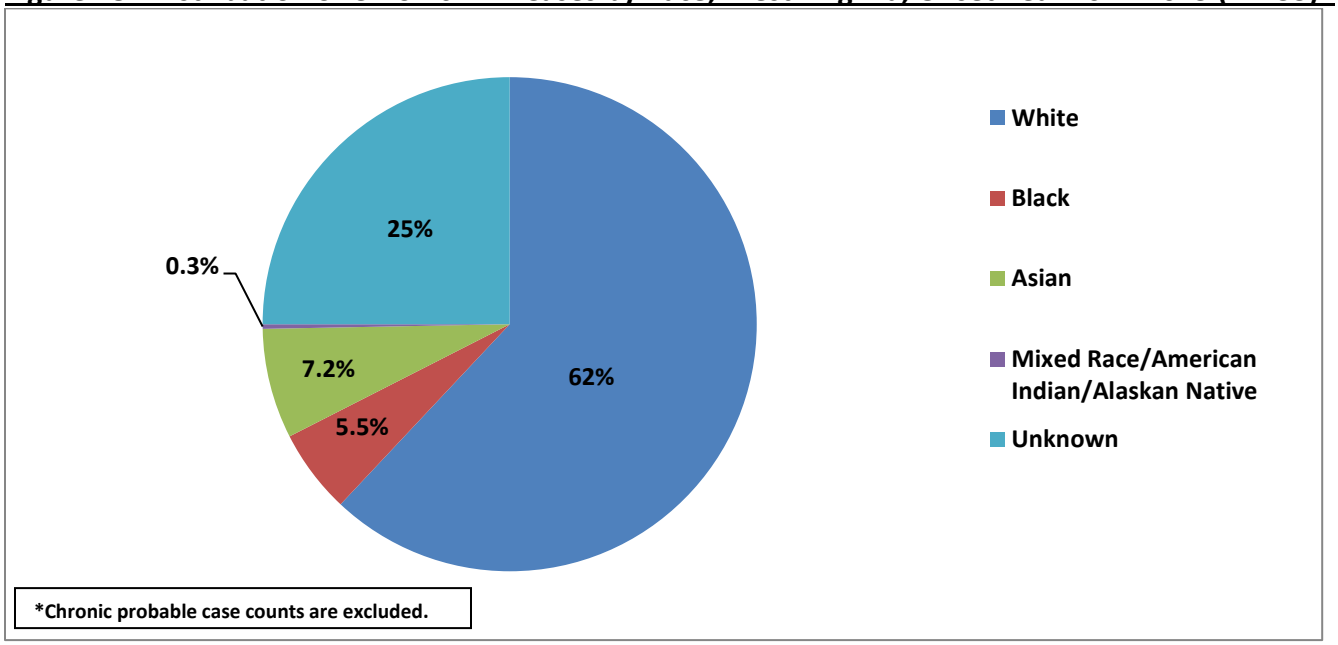


Figure 18 illustrates the distribution of chronic HBV cases by race. Most cases of chronic HBV from 2012-2015 identified their race as white non-Hispanic.

Figure 19. Incidence of Chronic HBV Cases by Age Group, West Virginia, Report Year 2012-2015 (n=755)*

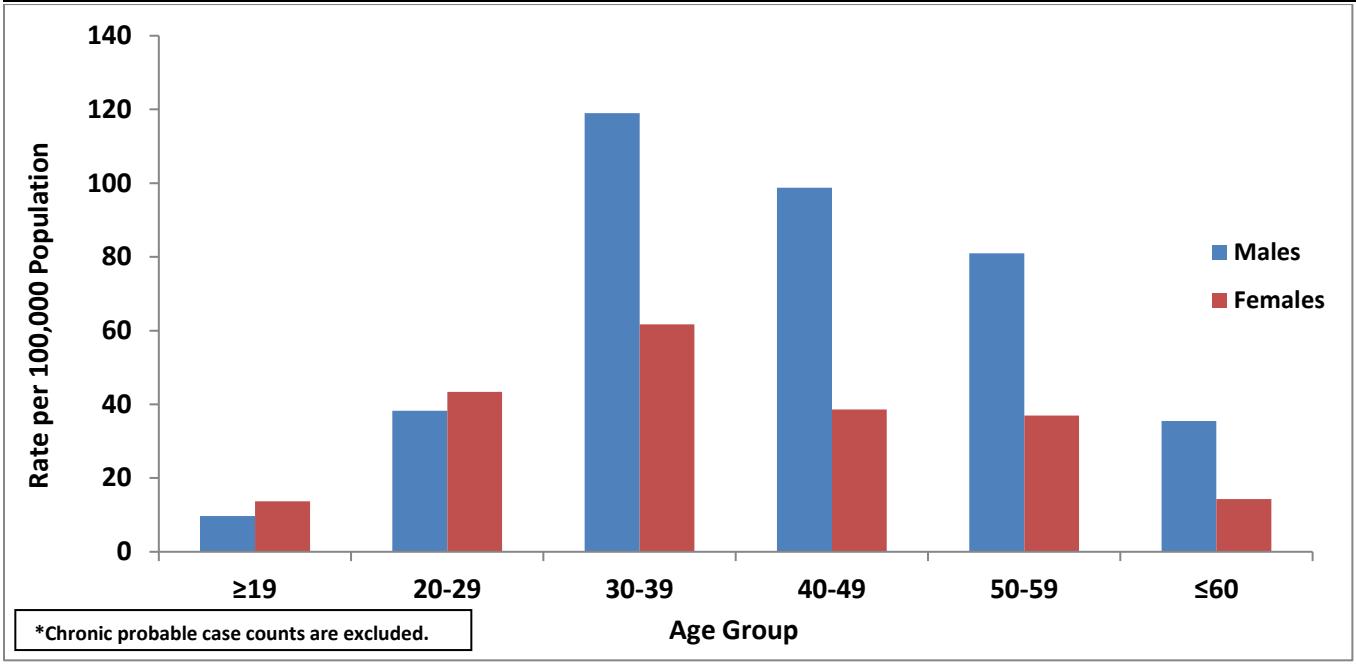


Figure 19 examines the rate per 100,000 population of newly reported cases of chronic HBV by age, reported between 2012-2015, with most cases of chronic HBV falling within the 30-39 year old age range.

Figure 20. Incidence of Chronic HBV Cases by Age and Report Year, West Virginia, 2012-2015 (n=755)*

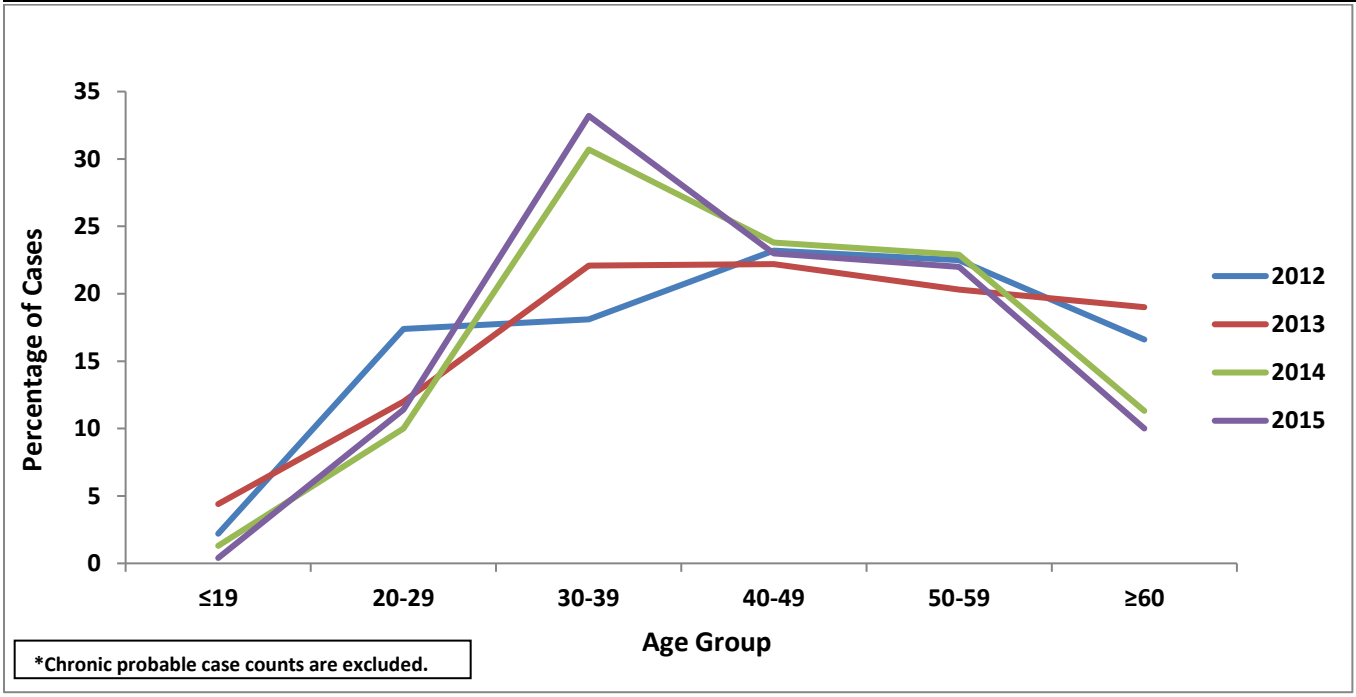
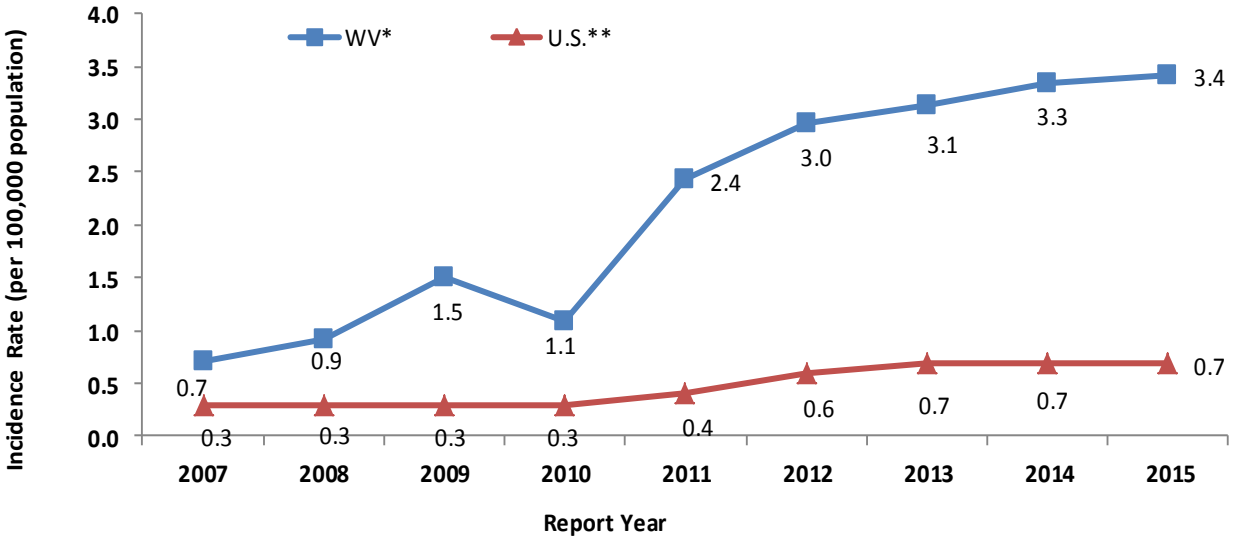


Figure 20 shows the trend of chronic HBV. The highest increase was noted among those ages 30-39.

Hepatitis C

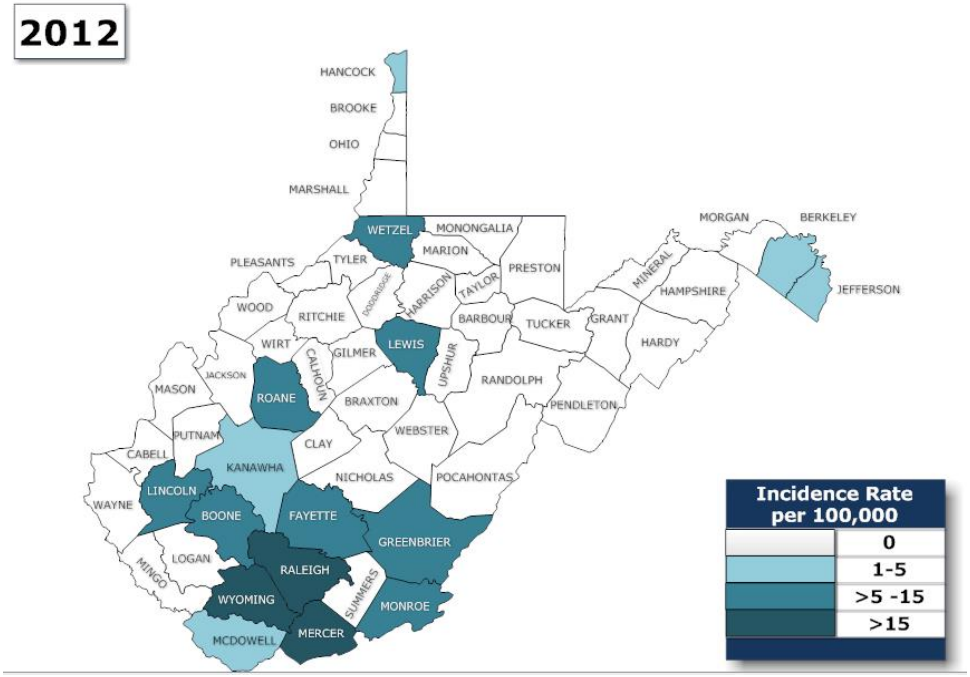
Figure 21. Incidence of Acute Confirmed HCV Cases by Year of Report, West Virginia (n=361) and the United States, 2007 – 2015

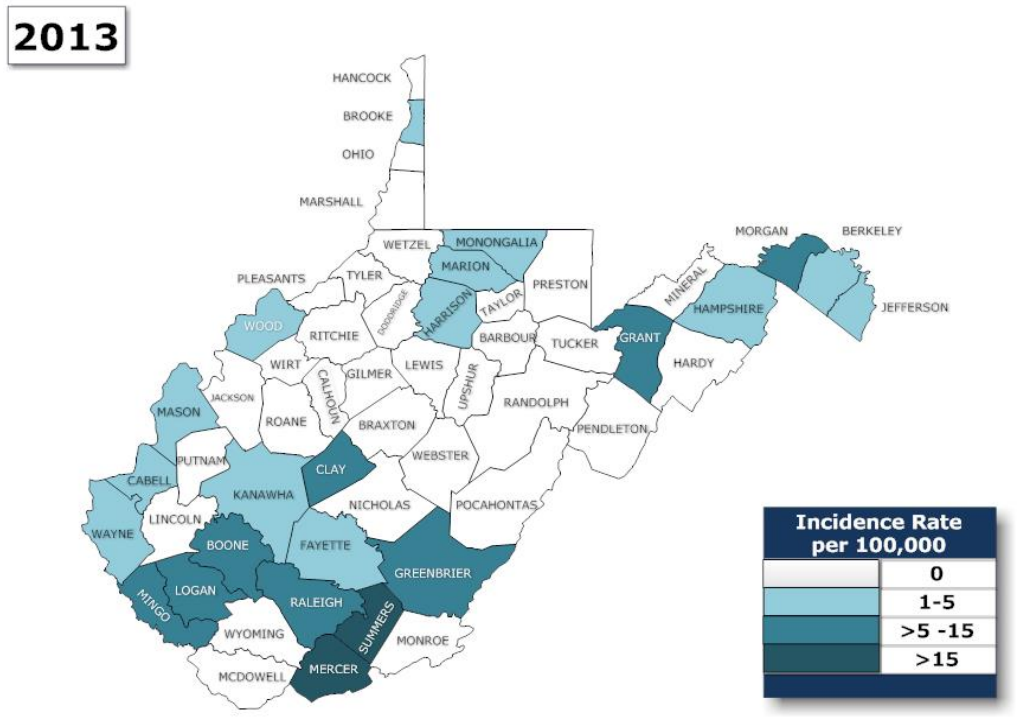


* West Virginia rate: Number of cases reported by year of report of disease, based on 2010 population estimate for years 2007-2014. 2015 population estimate used for 2015 incidence.
** http://www.cdc.gov/hepatitis/statistics/2014surveillance/pdfs/2014hepsurveillancerpt.pdf

Figure 21 illustrates that in 2015, 63 cases of acute confirmed HCV were reported in West Virginia. The incidence of HCV infection in 2015 was 3.4 cases per every 100,000 West Virginia residents. The national rate in 2014 was only 0.7 cases per every 100,000 person in the U.S.

Figure 22. Incidence of Acute Confirmed HCV Cases in 2012- 2015 by County of Residence





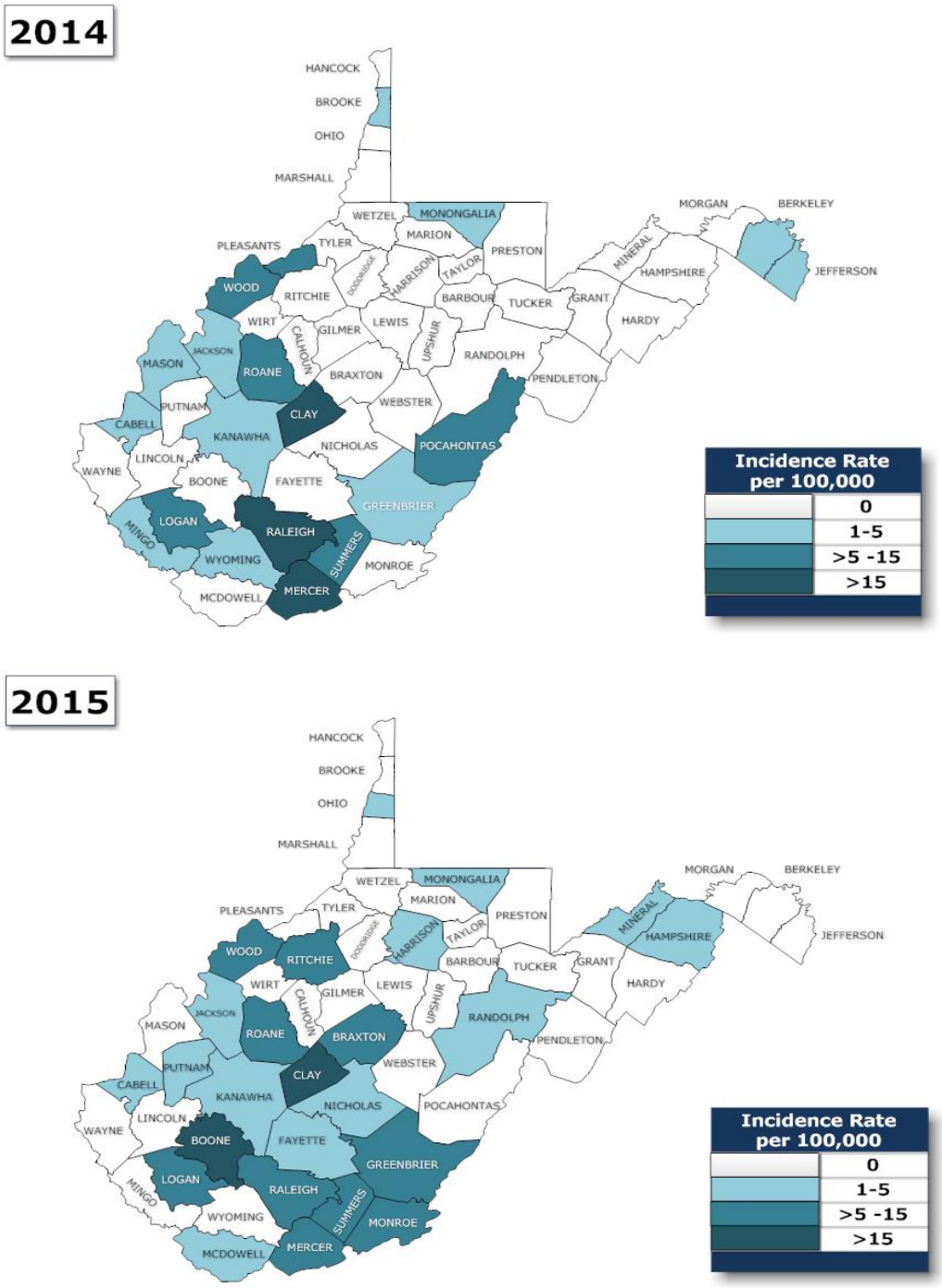


Figure 22 shows the incidence of acute HCV cases by patient's county of residence during 2012-2015. Southern counties, such as Mercer, had a higher incidence rate of acute HCV cases during 2012 to 2014. (35.3, 17.7 and 17.7 respectively for 2012, 2013 and 2014). Raleigh County had higher rates in 2012 (13.9) and 2014 (21.6)

Figure 23. Distribution of Acute HCV Cases by Age Group, West Virginia, Onset Year 2012-2015 (n=235)

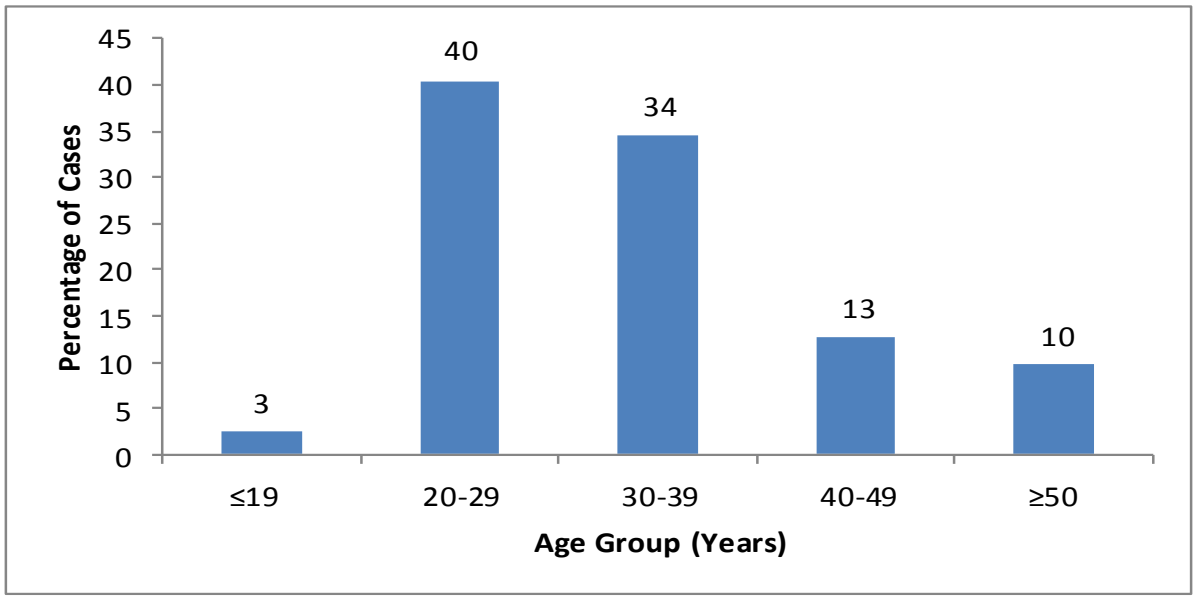


Figure 23 shows the age distribution of acute HCV cases in West Virginia during 2012-2015. Most incident cases were reported among 20-29 year age group (40%) followed by 30-39 years age group (34%).

Figure 24. Distribution of Acute Hepatitis C Cases by Age Group and Onset Year, West Virginia, 2007-2015 (n=235)

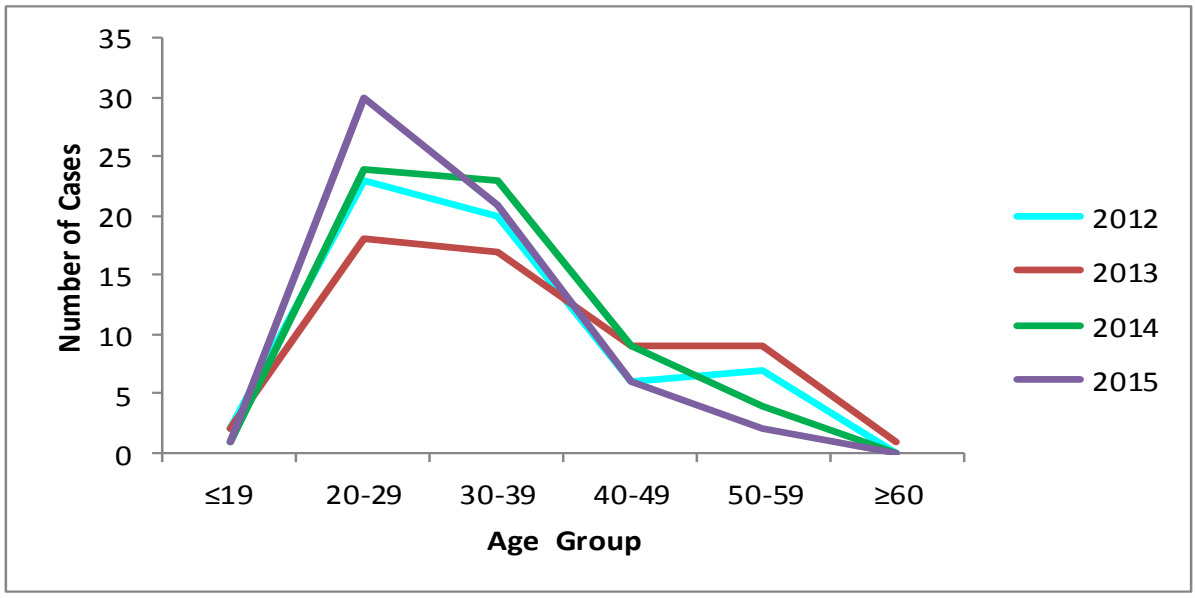
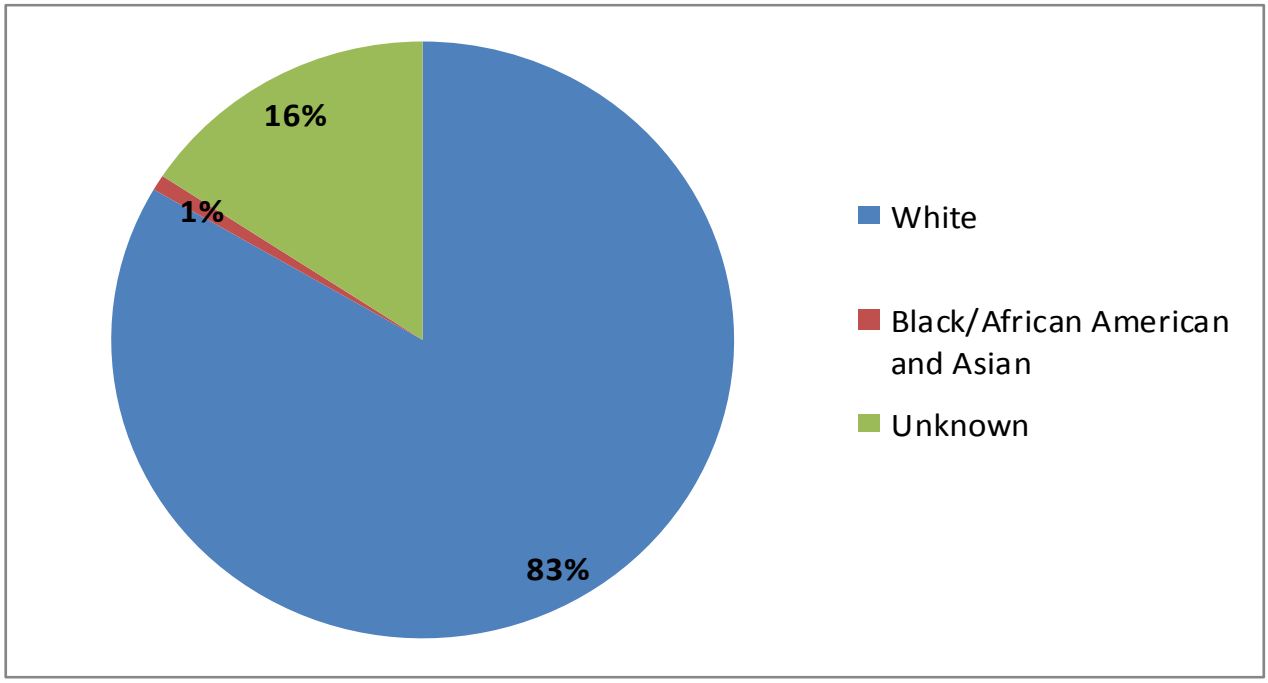


Figure 24 illustrates that between 2012 and 2015, incident cases of acute HCV infection were consistently increasing among the 20-29 year old age group. A similar pattern was observed among 50-59 age group, except in 2014 and 2015.

Figure 25. Distribution of Acute HCV Cases by Race, West Virginia, Onset Year 2012-2015 (n=235)



West Virginia population is predominantly white, which is also reflected in the incidence of acute HCV cases during 2012 to 2015 (Figure 25).

Figure 26. Distribution of Acute HCV Cases by Gender and Onset Year, West Virginia, 2012-2015 (n=235)

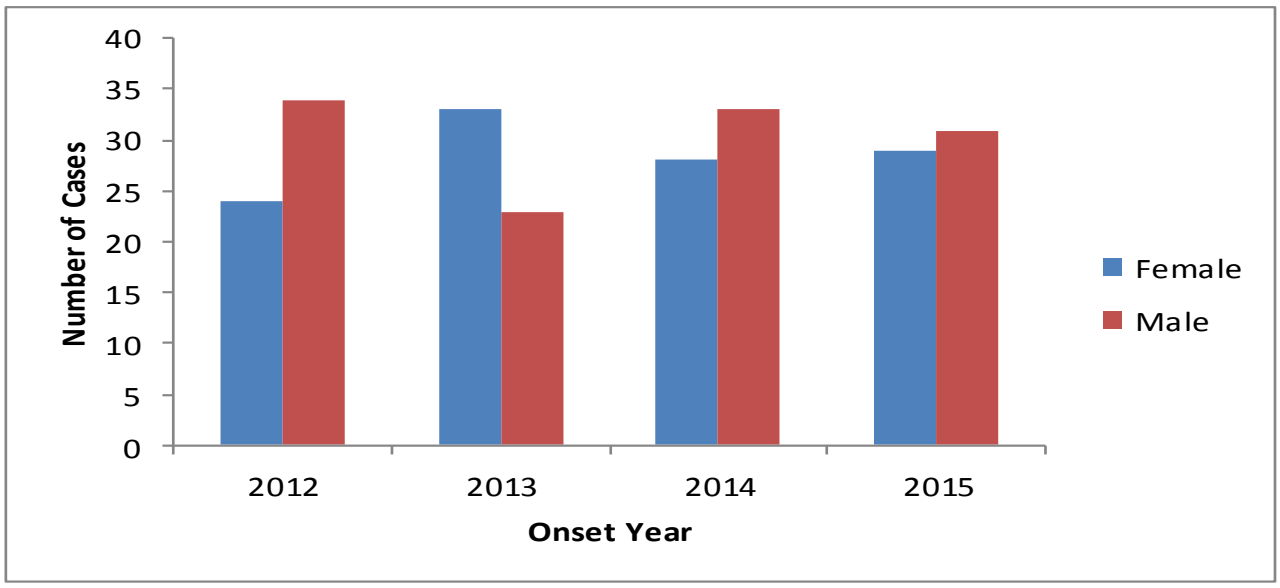
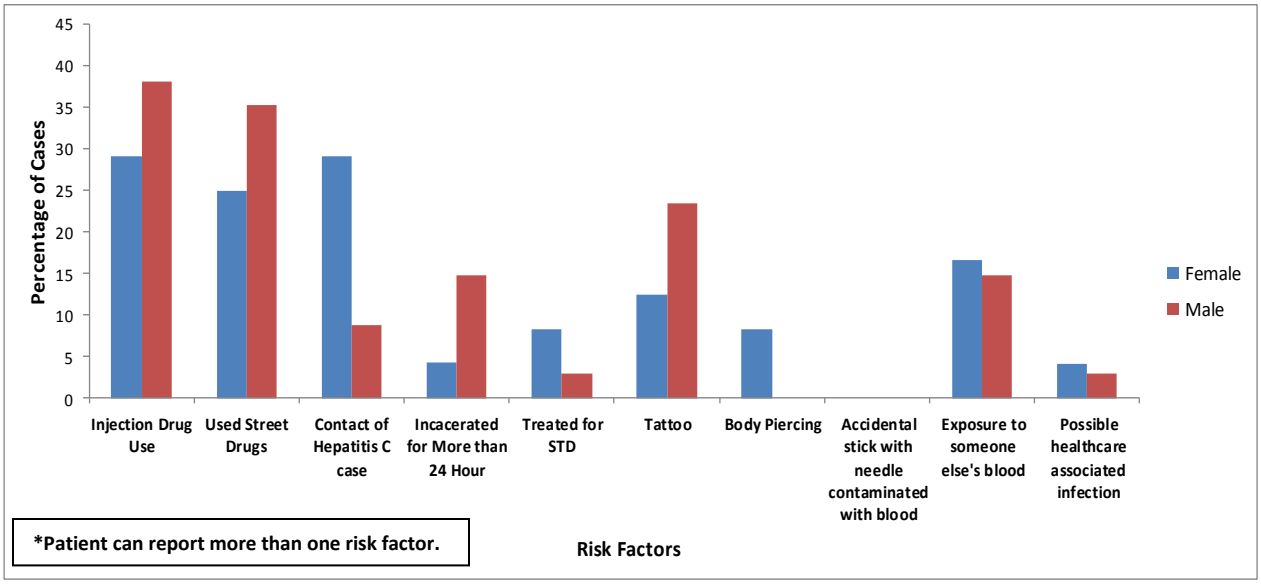


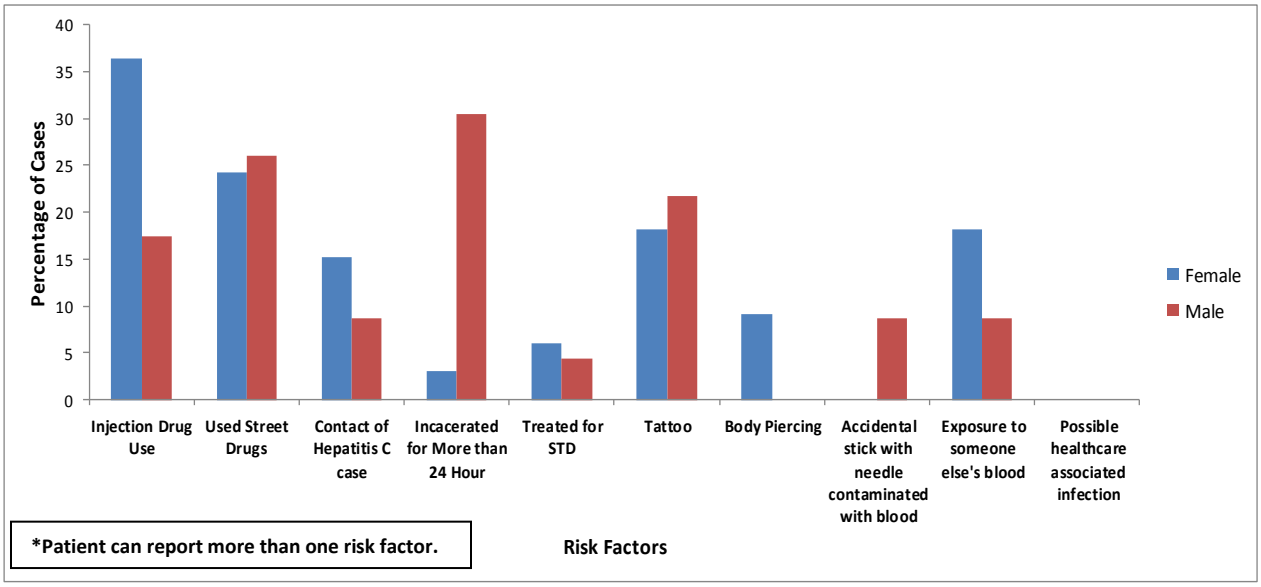
Figure 26 shows the distribution of acute HCV cases among males and females during 2012-2015. The number of cases varies across years among males and females.

Figure 27. Risk Factors* Reported Among Acute HCV Cases by Gender and Onset Year - West Virginia, 2012 (n=58)



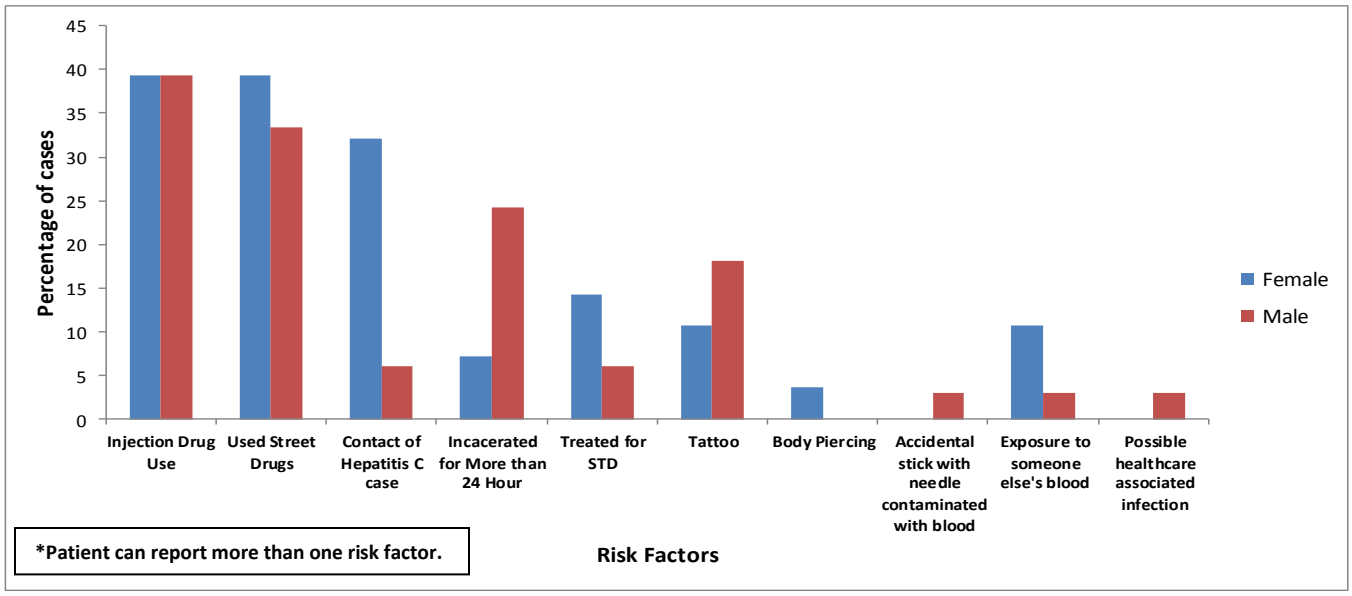
Injection drug use and street drug use were the most common risk factors for HCV infection in 2012 (Figure 15). Higher percentages of males reported drug use compared to females in 2012. Incarceration and tattoo were more frequently endorsed by males compared to females in 2012. (Figure 27).

Figure 28. Risk Factors* Reported Among Acute HCV Cases by Gender and Onset Year - West Virginia, 2013 (n=56)



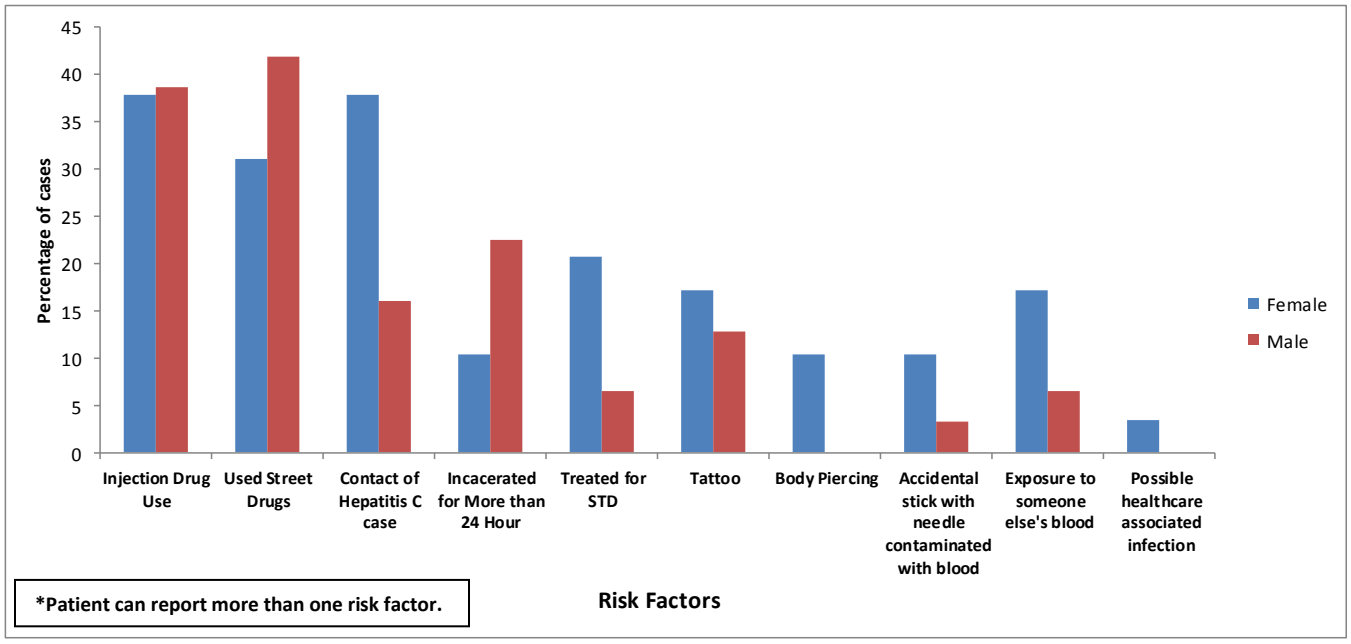
Injection drug use and street drug use were the major risk factors for HCV infection in 2013 (Figure 16). Higher percentages of female reported injection drug use compared to males in 2013. Incarceration was a major risk factor for males compared to females in 2013 (Figure 28).

Figure 29. Risk Factors* Reported Among Acute HCV Cases by Gender and Onset Year - West Virginia, 2014 (n=61)



Injection drug use and street drug use were the major risk factors for HCV infection in 2014. Higher percentages of females reported street drug use compared to males in 2014. Injection drug use and incarceration were higher among males compared with females in 2014 (Figure 29).

Figure 30. Risk Factors* Reported Among Acute HCV Cases by Gender and Onset Year - West Virginia, 2015 (n=60)



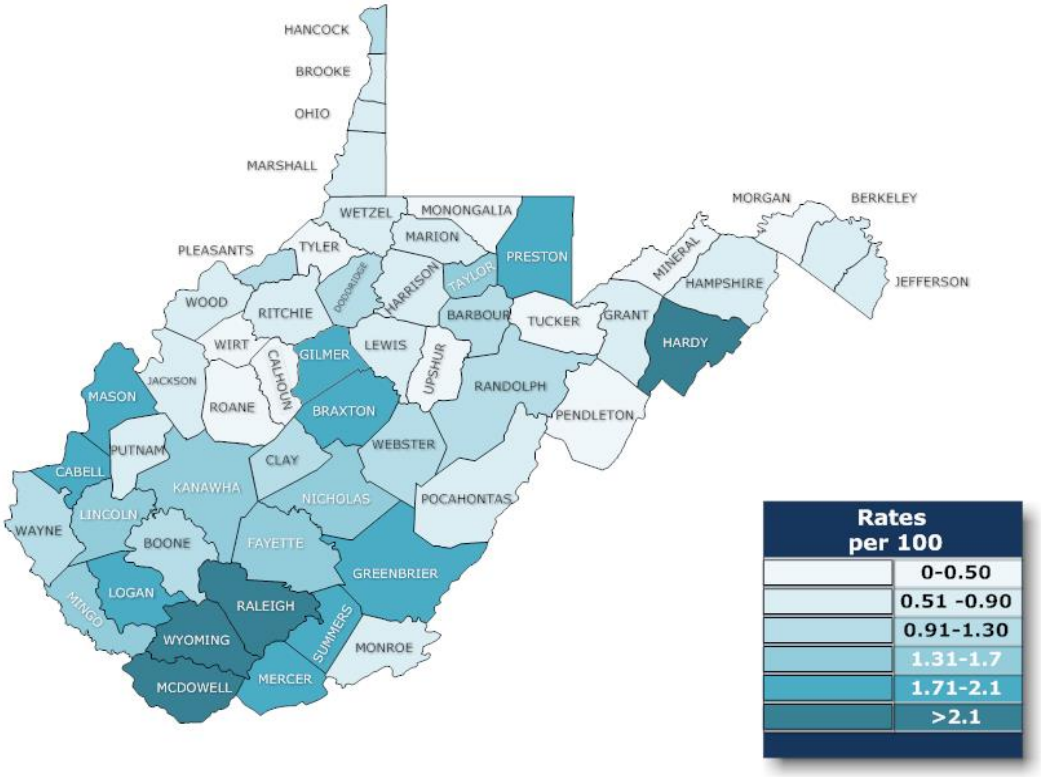
A larger proportion of males reported street drug use compared to females in 2015. Females were more likely to report contact with a known HCV case (Figure 30).

Table 3. Distribution of Acute HCV Cases by Gender, West Virginia, Year of Onset 2012-2015 (n=235)

Gender	Number of Cases	% of Total
Female	114	48.5%
Male	121	51.5%
Total	235	100.0%

Table 3 shows that cases of acute HCV infection were almost equally distributed among males and females during the entire 4 year period (2012 to 2015).

Figure 31. Cumulative Rates of Chronic HCV infection by County in West Virginia, 2012-2015 (n=21,276)



Most of the cases were reported from the southern counties during the 2012 to 2015. Raleigh, Wyoming and McDowell counties had greater than 2% of the poulations with chronic HCV infection (Figure 31).

Figure 32. Distribution of Chronic HCV Cases by Gender, West Virginia, 2012-2015 (n=21,276)

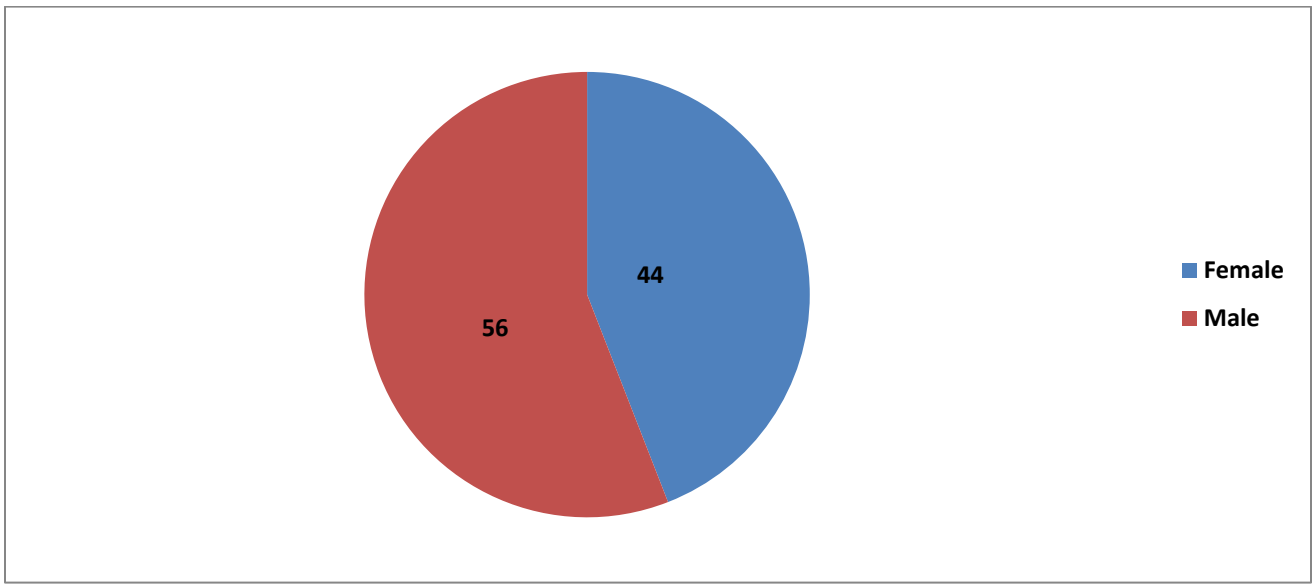


Figure 32 shows the gender distribution of chronic HCV infection in West Virginia during 2012-2015. More cases were reported among males compared to females.

Figure 33. Distribution of Chronic HCV Cases by Age Group, West Virginia, Report Year 2012-2015 (n=21,307)

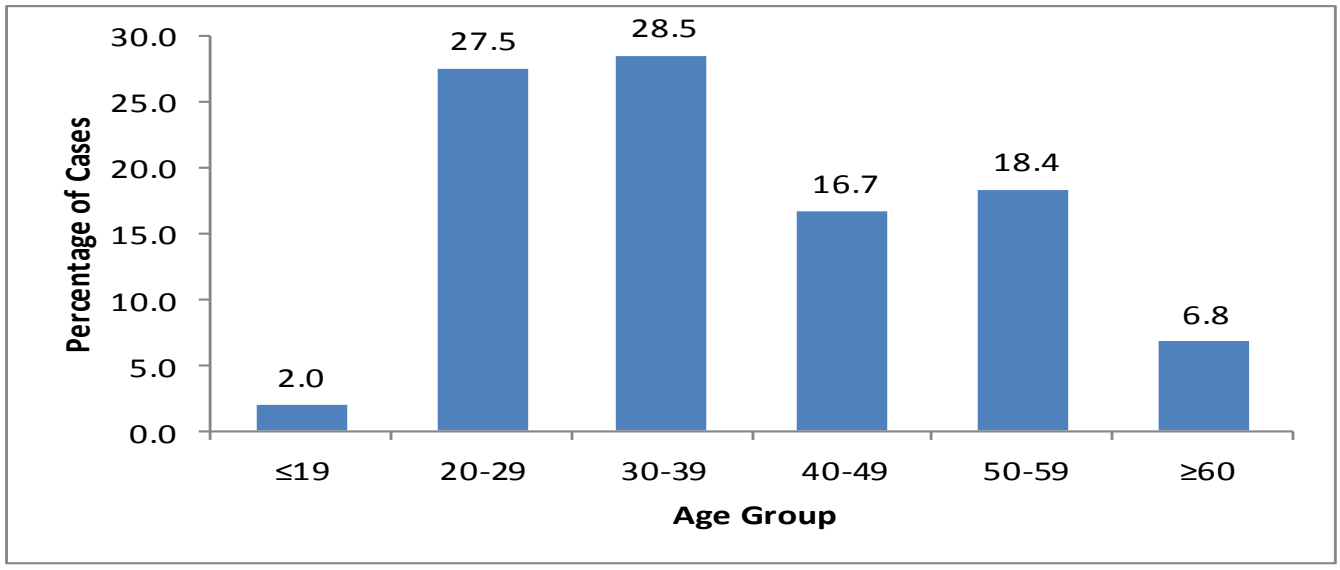
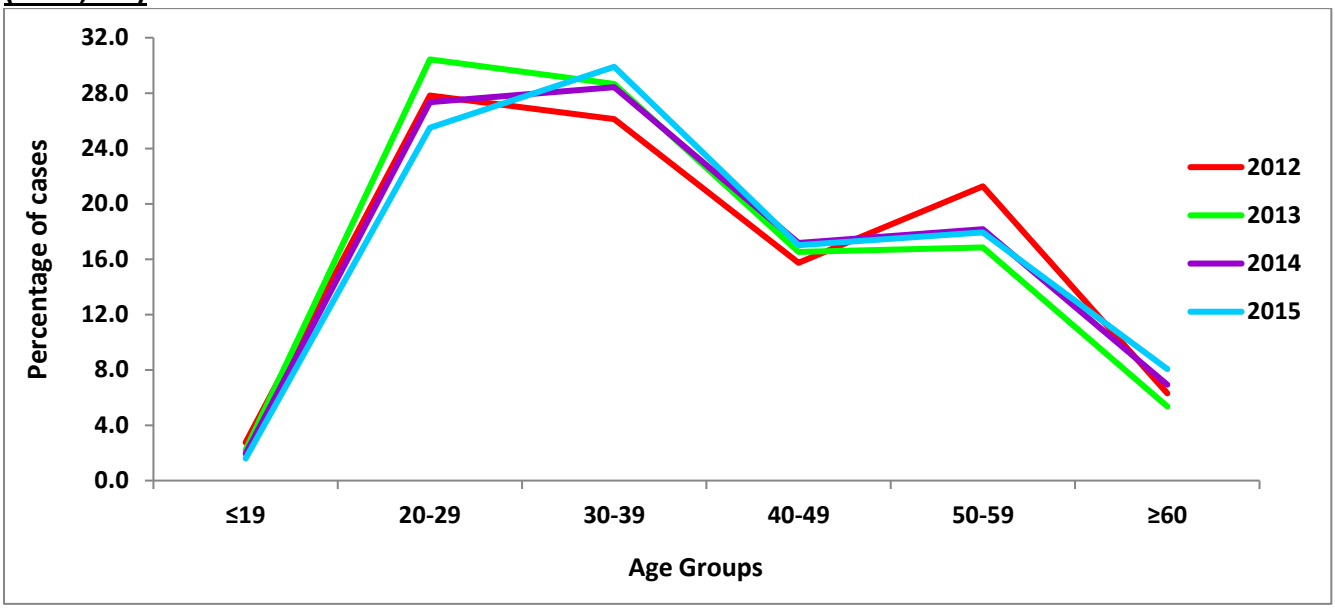


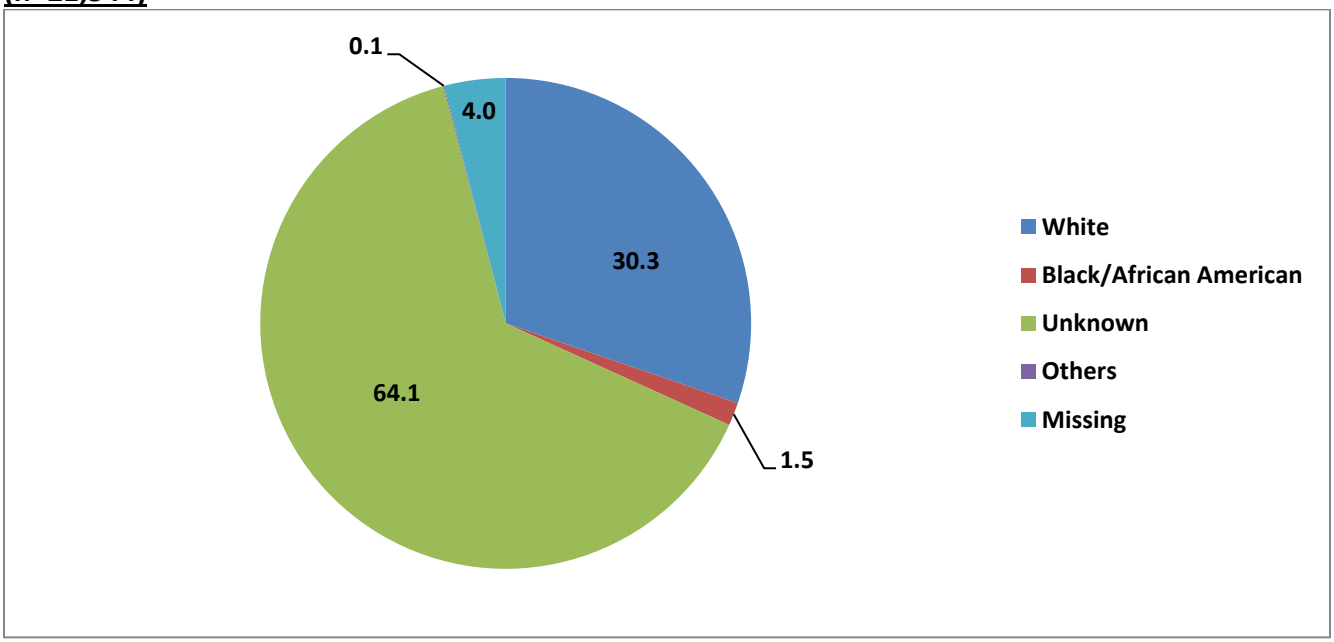
Figure 33 shows the age distribution of chronic HCV cases in West Virginia during 2012-2015. Most cases were reported in the 30-39 year age group followed by the 20-29 years age group.

Figure 34. Distribution of Chronic HCV Cases by Age and Report Year, West Virginia, 2012-2015 (n=21,307)



During 2012 to 2015, cases of chronic HCV infection were consistently higher among the 20-29 year old age group (Figure 34).

Figure 35. Distribution of Chronic HCV Cases by Race, West Virginia, Onset Year 2012-2015 (n=21,344)



During 2012 to 2015, a large amount of the reported cases of chronic HCV did not include race information. Only 32% of chronic HCV cases included patient race information (Figure 35).

Discussion

In 1986, Dr. Loretta Haddy, State Epidemiologist, and Dr. Mary Skinner wrote the WVDHHR Hepatitis B Clinical Control Services Policy 3220. This document was the first set of public health procedures in West Virginia put in place by the WVDHHR to protect healthcare workers and patients from HBV by establishing guidelines to control the spread of HBV infection in healthcare settings. HBV and HCV infections became reportable conditions by law in West Virginia in 1999 and the obligation for the HBV vaccine became required for all children in state schools, or a state-regulated child care centers, in 2008 per WV Code §16-3-4(c). West Virginia experienced a 227% increase from 2007 to 2015 in the number of acute confirmed cases of HBV (Figure 1), a 276% increase in the incidence of chronic HBV (Figure 12), and a 386% increase of acute HCV cases (Figure 21).

In 2011, West Virginia reported a rate of 6.2 acute HBV infections per 100,000 population, six times the national average of 0.9 per 100,000, and 2.4 acute HBV infections per 100,000 population, six times the national average of 0.4 per 100,000. From 2011 to 2015, rates of acute and chronic viral hepatitis have continued to steadily increase in West Virginia.

In 2015, West Virginia reported record high rates of acute HBV infection at 14.7 per 100,000 West Virginia residents, 14 times the national average, (Figure 1) and 3.4 per 100,000 persons were acutely infected with HCV, five times the national average (Figure 21). Since 2007, West Virginia has reported the highest incidence of acute HBV infection, and the second highest incidence of acute HCV infection in the U.S. The increase in HBV and HCV infection between 2012-2015 is most common among non-Hispanic white persons among 30-39 years of age who also report high risk drug activity (Harris et al., 2016). Other trends in high risk behavior of those who acquired HBV or HCV between 2012-2015 included the use of street drugs (non-intravenous) and incarceration. From 2012 to 2015, the proportion of those who inject drugs among acute HBV and HCV cases has varied among males and females, but has continued to consistently be most predominant among the 30-39 age groups for both males and females. Of those chronically infected with HBV and HCV, males who are white non-Hispanic and aged 30-39 years (Figures 17,18,19,32,33 and 35) had the highest rates.

The increase in the incidence of acute and chronic HBV and HCV infections is believed to be related to the increase in the abuse of prescription opioids and injection drug use (IDU) (Harris et al. 2016). In the U.S., from 2010 through 2013, there was a significant increase in the abuse of heroin (Iqbal et al., 2015). The proportions of heroin admissions have increased, whereas the proportions of prescription opioid admissions have decreased in West Virginia (Zibell et al., 2015). It is believed that tighter restrictions on accessing prescription opioids led to increased abuse of illegal and more readily available intravenous drugs such as heroin, which pose a great risk for transmission of viral infection such as HBV, HCV, and HIV (Harris et al., 2016). Injection drug use and street drug use have continued to be leading risk factors for HBV and HCV infection in West Virginia during the last five years. This increase in heroin use is consistent with national survey reports estimating an increase in first time heroin use (Maxwell, 2011). As a result, increases in acute HBV and HCV infections in West Virginia are a byproduct of the growth of opioid abuse and the number of persons who inject illegal street drugs.

The percentage of HBV and/or HCV cases with reported history of incarceration has also increased in the last four years due to viral hepatitis testing upon admission. Viral hepatitis is more prevalent among correctional inmates than the general population, although there are no definitive numbers to report (Coalition of Correctional Health Authorities American Correctional Association, 2015). Higher rates of chronic HBV and past or present HCV cases were reported from counties with federal prisons such as Gilmer, Preston and

McDowell counties (Appendix 4). The Coalition of Correctional Health Authorities American Correctional Association (2015) reported that there is inconsistency across correctional systems in HBV and/or HCV infection testing practices, as well as in education and treatment involving prevention of viral hepatitis infection. Therefore, the surveillance data may not capture the true burden of HBV and/or HCV cases among the incarcerated population.

After physician notification to the WVDHHR about an unusual case of HCV in an elderly patient who reported no high risk behavior, an investigation of possible healthcare-associated transmission of hepatitis C was initiated. After extensive investigation, two clusters of hepatitis B and two clusters of hepatitis C (including the index patient) were identified in association with Clinic A. Notification of the recommendation for blood borne pathogen testing (HBV, HCV, and HIV) was sent to >2,300 patients of Clinic A in 2016.

Chronic HBV and HCV infections account for more than 50% of new cases of chronic liver disease reported, which is a leading cause of death in West Virginia (West Virginia 2015 State Health Profile). The increase in incidence of HBV and HCV infections will likely contribute to an increase in liver-related morbidity and mortality. Interventions that aim at educating and assisting those who exhibit high risk behavior are needed to decrease the rate of HBV and HCV infection in West Virginia (Harris et al., 2016).

West Virginia Viral Hepatitis Initiatives

A. Viral Hepatitis Prevention Coordinator

Since 2004, West Virginia has had one Viral Hepatitis Prevention Coordinator (VHPC) who provides hepatitis information to the public. This includes education on viral hepatitis prevention, testing, and patient linkage to care/medical providers. The VHPC also provides education to school systems, addiction treatment centers, harm reduction/syringe service programs and correctional facilities.

B. Hepatitis Regional Training

From December 2015 to April 2016, the VHPC, in collaboration with Hepatitis B and C Epidemiologists and Perinatal Hepatitis B Prevention Coordinator, provided six regional hepatitis trainings across West Virginia to local health department (LHD) nurses and others involved in HBV and HCV investigations. LHD personnel were provided with education on how to properly investigate and educate patients on viral hepatitis, ways for patients to prevent disease transmission and steps patients must take to manage their infection with connection to physician care.

C. Electronic Laboratory Reporting

In 2015, three commercial laboratories (LabCorp®, Mayo Medical Laboratories®, and Quest Diagnostics®) started reporting test results as electronic laboratory reports. Electronic lab reporting has decreased human error and non-reporting due to the automatic transmission of positive viral hepatitis results from the resulting laboratory directly to the WVEDSS. This resulted in an increase in viral hepatitis reporting and increased detection of cases in 2015.

D. Hepatitis B Pilot Project

In response to the growing rate of acute HBV infections in West Virginia, the CDC funded the Adult Hepatitis B Vaccination Pilot Project (AHBVPP). The AHBVPP was implemented in January 2013 in 17 counties in West Virginia with the highest reported incidence of acute HBV infection in 2012 to reduce the number of new cases of HBV in West Virginia by immunizing adults at risk (Harris et al., 2016). The project's goal was to reach adults at risk for HBV infection in settings serving high-risk populations such as STD clinics, HIV care facilities, correctional facilities and substance abuse treatment facilities. All participating local health departments implemented standing HBV vaccination orders, provided HBV education, and vaccinated all adults requesting protection from HBV infection regardless of risk (Epi-log fourth quarter 2015). The AHBVPP ended in 2015.

E. Harm Reduction

To reduce the increasing numbers of HBV and/or HCV among those who inject drugs, several counties in West Virginia implemented harm reduction programs under the model of Syringe Access Programs (SAPs). SAPs aim to reduce the risk of spreading HBV, HCV, and HIV by providing access to sterile syringes and needles to the public to discourage the reuse and sharing of syringes between drug partners during drug activity in return for used and/or dirty needles from those receiving sterile equipment. Between 2014 and 2015, three West Virginia LHDs (Cabell, Kanawha, and Ohio Counties) implemented SAPs to combat viral HBV and HCV infection among injection drug users.

F. Surveillance

In 2015, West Virginia received more than 33,000 HBV and HCV laboratory reports (paper and electronic laboratory reports). Through partnership with West Virginia local health departments and the DIDE, new incidences of acute HBV, HCV, and chronic HBV are investigated by the local health department of the county of residence of the patient. Patients are interviewed for risk factors and disease contacts, assisted in finding an infectious disease specialist and are provided with viral hepatitis education to prevent the spread of disease. Surveillance activities and case reporting of HBV and HCV are managed and reported to the CDC by West Virginia's Hepatitis B Epidemiologist, Hepatitis C Epidemiologist, and Hepatitis C Registrar.

G. Perinatal Hepatitis B

Hepatitis B infection in a pregnant mother poses a risk of vertical disease transmission to the unborn child during childbirth. The Division of Immunization Services, in collaboration with the Hepatitis B Epidemiologist receives all reports of HBV infection among pregnant women. Reports of HBV positive pregnant women are received from providers, labs, or the West Virginia Health Statistics Center (Vital Statistics). All pregnant women should be screened for HBV before delivery of the infant. At birth, infants of HBV positive pregnant women receive the HBV vaccine and HBIG within 12 hours of birth to prevent vertical transmission of HBV from mother to child. The disease intervention specialist (DIS) conducts case management on each HBV positive pregnant mother to ensure the delivery facility is prepared to administer PEP and HBV vaccine to the infant, as well as follow up to ensure the infants receive the following two doses of the HBV vaccine at two months of age and at six months of age.

Recommendations

- A statewide extensive provider education is needed to reduce non-reporting, provide better patient education and increase hepatitis testing.
- Accurate documentation from primary care providers of patient vaccination records to better examine HBV vaccine failure in those infected and HBV vaccine non-responders.
- Staffing resources available to track and accurately reflect the incidence of chronic HCV in West Virginia.

Data Limitations

- HBV and HCV surveillance data relies solely on passive disease reporting from providers, hospitals, laboratories and the community. The data presented in this report is a representation of data accumulated from reporting entities, as well as local and state health case investigations from 2012 to 2015.
- Cases from correctional facilities in West Virginia are included in this report and may inflate figures well above what would be seen in the general population at large. It is not possible to calculate rates for incarcerated and non-incarcerated populations separately.
- Values shown in this report are expressed as the rate of infection per 100,000 population. A single case report in a county with a small population can produce an alarmingly high rate of infection for that county.
- Rates of infection shown in this report for acute HBV, chronic HBV, and acute HCV are incidence rates. However, due to a change in data systems in West Virginia in 2012, some cases of past/present HCV have already been reported to public health in years prior to 2012. The past/present HCV figures **should not** be viewed as incidence rates.
- WVEDSS is a passive surveillance system and some cases may not be reported, including West Virginia residents who may seek medical care outside of the state of West Virginia.
- Patients can be difficult to locate due to changing or unreliable contact information.
- Risk factor information is per patient report or per provider history and physical report.
- Difficulty in tracking and locating high-risk patients attribute to large amounts of incomplete information and more cases with incomplete data.
- Some LHDs and health care providers are more vigilant in detecting, investigating and reporting HBV and HCV which can account for an increase in the number of cases observed in certain counties.
- Patient vaccination records are per patient record and are not always verified by the patient's primary care physician.
- Risk factor information is not collected for chronic HBV and HCV cases.
- Many patients with HBV or HCV are asymptomatic and do not seek medical care. Therefore, the numbers shown in this report may not reflect the true burden of these illnesses within West Virginia.
- These figures are accurate as of May 31, 2016, but may be revised as new information becomes available to public health.

Appendices

Appendix 1. Incidence of Acute Confirmed HBV infection by County, West Virginia 2012-2015

Acute Hepatitis B by Year of Report, WV, 2012-2015 *																	
	2012		2013		2014		2015			2012		2013		2014		2015	
County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000
Barbour		0.0		0.0	1	6.0		0.0	Mineral	1	3.5		0.0		0.0	1.0	3.6
Berkeley	11	10.6	9	8.6	11	10.6	15.0	13.4	Mingo	18	67.1	9	33.5	8	29.8	9.0	35.6
Boone	1	4.1	8	32.5	3	12.2	15.0	64.2	Monongalia		0.0		0.0	3	3.1	3.0	2.9
Braxton		0.0		0.0	2	13.8	1.0	6.9	Monroe	1	7.4	2	14.8		0.0		0.0
Brooke	1	4.2	4	16.6	1	4.2	2.0	8.6	Morgan	1	5.7		0.0		0.0		0.0
Cabell	9	9.3	8	8.3	10	10.4	16.0	16.5	Nicholas	1	3.8	3	11.4	1	3.8	2.0	7.8
Calhoun	1	13.1		0.0		0.0		0.0	Ohio	1	2.3		0.0	1	2.3	2.0	4.6
Clay		0.0	1	10.7		0.0	8.0	89.8	Pendleton		0.0		0.0		0.0	0.0	0.0
Doddridge		0.0		0.0	3	36.6	1.0	12.2	Pleasants		0.0		0.0	1	13.1		0.0
Fayette		0.0	2	4.3	5	10.9		0.0	Pocahontas		0.0		0.0		0.0		0.0
Gilmer		0.0		0.0		0.0		0.0	Preston		0.0	1	3.0	1	3.0		0.0
Grant		0.0	1	8.4		0.0		0.0	Putnam	4	7.2	10	18.0	16	28.8	14.0	24.6
Greenbrier	1	2.8		0.0	2	5.6	3.0	8.4	Raleigh	8	10.1	23	29.2	23	29.2	28.0	36.1
Hampshire	1	4.2		0.0		0.0		0.0	Randolph		0.0	1	3.4		0.0		0.0
Hancock	3	9.8	3	9.8		0.0	1.0	3.4	Ritchie		0.0		0.0	1	9.6	1.0	10.0
Hardy		0.0		0.0		0.0		0.0	Roane		0.0		0.0	1	6.7	2.0	13.9
Harrison	11	15.9	11	15.9		0.0	9.0	13.1	Summers	3	21.5	5	35.9	4	28.7	1.0	7.6
Jackson		0.0	5	17.1	1	3.4	11.0	37.6	Taylor	1	5.9		0.0		0.0	1.0	14.4
Jefferson	6	11.2	4	7.5	4	7.5	4.0	7.1	Tucker		0.0		0.0		0.0		0.0
Kanawha	17	8.8	40	20.7	42	21.8	71.0	37.7	Tyler		0.0		0.0	1	10.9		0.0
Lewis		0.0	2	12.2		0.0		0.0	Upshur	1	4.1		0.0		0.0		0.0
Lincoln	1	4.6	1	4.6	4	18.4	8.0	37.4	Wayne	3	7.1	3	7.1	2	4.7	6.0	14.6
Logan	6	16.3	8	21.8	5	13.6	8.0	23.1	Webster		0.0		0.0	1	10.9		0.0
Marion		0.0	1	1.8	2	3.5	1.0	1.8	Wetzel		0.0	1	6.0	2	12.1	6.0	38.0
Marshall	1	3.0	1	3.0		0.0		0.0	Wirt		0.0		0.0		0.0		0.0
Mason	9	32.9	6	22.0	2	7.3		0.0	Wood		0.0		0.0	7	8.1	6.0	6.9
McDowell	6	27.1	5	22.6	7	31.7	1.0	5.0	Wyoming	4	16.8	4	16.8	1	4.2	3.0	13.5
Mercer	7	11.2	13	20.9	7	11.2	12.0	19.6	**West Virginia**	**139**	**7.6**	**195**	**10.6**	**186**	**10.0**	**272.0**	**14.7**

Appendix 1 outlines the incidence per 100,000 residents of Acute HBV by county from 2012-2015.

Appendix 2. Incidence of Chronic HBV infection by County, West Virginia 2012-2015

Chronic Hepatitis B, WV, 2012-2015									
	Rate/100,000					Rate/100,000			
County	2012	2013	2014	2015	County	2012	2013	2014	2015
Barbour	0.0	12.1	0.0	6.0	Mineral	3.5	7.1	0.0	3.6
Berkeley	13.4	11.5	18.2	8.0	Mingo	14.9	11.2	22.4	15.8
Boone	12.2	12.2	44.7	25.7	Monongalia	16.6	12.5	22.9	17.3
Braxton	6.9	13.8	20.7	6.9	Monroe	0.0	7.4	7.4	7.4
Brooke	0.0	4.2	16.6	4.3	Morgan	5.7	11.4	5.7	0.0
Cabell	8.3	10.4	14.5	29.9	Nicholas	3.8	15.2	0.0	15.6
Calhoun	0.0	0.0	0.0	13.4	Ohio	0.0	4.5	11.3	4.6
Clay	0.0	0.0	0.0	33.7	Pendleton	0.0	0.0	13.0	0.0
Doddridge	12.2	24.4	36.6	12.2	Pleasants	13.1	13.1	13.1	0.0
Fayette	8.7	13.0	13.0	8.9	Pocahontas	34.4	11.5	11.5	11.6
Gilmer	11.5	11.5	34.5	23.5	Preston	6.0	11.9	23.9	17.7
Grant	0.0	0.0	16.8	0.0	Putnam	5.4	12.6	14.4	14.1
Greenbrier	11.3	2.8	11.3	16.9	Raleigh	11.4	20.3	36.8	34.8
Hampshire	4.2	0.0	0.0	8.6	Randolph	0.0	3.4	0.0	10.3
Hancock	9.8	13.0	13.0	20.1	Ritchie	38.3	0.0	19.1	0.0
Hardy	7.1	0.0	21.4	0.0	Roane	0.0	0.0	0.0	0.0
Harrison	0.0	5.8	7.2	20.4	Summers	14.4	21.5	35.9	52.9
Jackson	0.0	0.0	13.7	20.5	Taylor	11.8	35.5	0.0	43.1
Jefferson	5.6	20.6	26.2	7.1	Tucker	0.0	0.0	0.0	28.7
Kanawha	9.3	15.0	19.2	19.6	Tyler	10.9	0.0	0.0	0.0
Lewis	6.1	18.3	6.1	0.0	Upshur	4.1	0.0	8.2	12.1
Lincoln	9.2	23.0	18.4	32.7	Wayne	4.7	4.7	9.4	9.8
Logan	10.9	16.3	16.3	34.6	Webster	0.0	0.0	0.0	0.0
Marion	1.8	5.3	1.8	5.3	Wetzel	0.0	0.0	18.1	6.3
Marshall	0.0	3.0	6.0	9.4	Wirt	0.0	0.0	0.0	17.0
Mason	11.0	25.6	32.9	22.2	Wood	8.1	8.1	8.1	9.3
McDowell	36.2	40.7	54.3	35.3	Wyoming	29.4	29.4	33.6	27.1
Mercer	25.7	16.1	49.8	42.5	**WV TOTAL**	**7.4**	**8.5**	**12.5**	**12.4**

Appendix 2 outlines the incidence per 100,000 residents of Chronic HBV by county from 2012-2015.

Appendix 3. Incidence of Acute Confirmed HCV infection by County, West Virginia 2012-2015

Acute Hepatitis C by Year of Report, WV, 2012-2015 *																		
	2012		2013		2014		2015			2012		2013		2014		2015		
County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000
Barbour	0	0.0	0	0.0	0	0.0	0	0.0	Mineral	0	0.0	0	0.0	0	0.0	1	3.6
Berkeley	1	1.0	2	1.9	1	1.0	0	0.0	Mingo	0	0.0	2	7.5	1	3.7	0	0.0
Boone	0	0.0	2	8.1	0	0.0	4	17.1	Monongalia	0	0.0	1	1.0	1	1.0	1	1.0
Braxton	0	0.0	0	0.0	0	0.0	1	6.9	Monroe	2	14.8	0	0.0	0	0.0	1	7.4
Brooke	0	0.0	1	4.2	1	4.2	0	0.0	Morgan	0	0.0	1	5.7	0	0.0	0	0.0
Cabell	0	0.0	2	2.1	1	1.0	4	4.1	Nicholas	0	0.0	0	0.0	0	0.0	1	3.9
Calhoun	0	0.0	0	0.0	0	0.0	0	0.0	Ohio	0	0.0	0	0.0	0	0.0	1	2.3
Clay	0	0.0	1	10.7	2	21.3	2	22.4	Pendleton	0	0.0	0	0.0	0	0.0	0	0.0
Doddridge	0	0.0	0	0.0	0	0.0	0	0.0	Pleasants	0	0.0	0	0.0	0	0.0	1	13.0
Fayette	3	6.5	1	2.2	0	0.0	1	2.2	Pocahontas	0	0.0	0	0.0	0	0.0	1	11.6
Gilmer	0	0.0	0	0.0	0	0.0	0	0.0	Preston	0	0.0	0	0.0	0	0.0	0	0.0
Grant	0	0.0	1	8.4	0	0.0	0	0.0	Putnam	0	0.0	0	0.0	0	0.0	1	1.8
Greenbrier	2	5.6	5	14.1	1	2.8	3	8.4	Raleigh	11	13.9	10	12.7	17	21.6	10	12.9
Hampshire	0	0.0	0	0.0	1	4.2	1	4.3	Randolph	0	0.0	0	0.0	0	0.0	1	3.4
Hancock	1	3.3	0	0.0	0	0.0	0	0.0	Ritchie	0	0.0	0	0.0	0	0.0	1	10.0
Hardy	0	0.0	0	0.0	0	0.0	0	0.0	Roane	1	6.7	0	0.0	1	6.7	2	13.9
Harrison	0	0.0	0	0.0	1	1.4	2	2.9	Summers	0	0.0	4	28.7	1	7.2	1	7.6
Jackson	0	0.0	0	0.0	1	3.4	0	0.0	Taylor	0	0.0	0	0.0	0	0.0	0	0.0
Jefferson	2	3.7	1	1.9	1	1.9	0	0.0	Tucker	0	0.0	0	0.0	0	0.0	0	0.0
Kanawha	1	0.5	2	1.0	4	2.1	3	1.6	Tyler	0	0.0	0	0.0	0	0.0	0	0.0
Lewis	0	0.0	1	6.1	0	0.0	0	0.0	Upshur	0	0.0	0	0.0	0	0.0	0	0.0
Lincoln	2	9.2	0	0.0	0	0.0	0	0.0	Wayne	0	0.0	1	2.4	0	0.0	0	0.0
Logan	0	0.0	5	13.6	8	21.8	3	8.6	Webster	0	0.0	0	0.0	0	0.0	0	0.0
Marion	0	0.0	1	1.8	0	0.0	0	0.0	Wetzel	1	6.0	0	0.0	1	6.0	0	0.0
Marshall	0	0.0	0	0.0	0	0.0	0	0.0	Wirt	0	0.0	0	0.0	0	0.0	0	0.0
Mason	0	0.0	1	3.7	1	3.7	0	0.0	Wood	0	0.0	2	2.3	5	5.8	8	9.3
McDowell	1	4.5	0	0.0	0	0.0	1	5.0	Wyoming	5	21.0	0	0.0	1	4.2	0	0.0
Mercer	22	35.3	11	17.7	11	17.7	7	11.4	**West Virginia**	**55**	**3.0**	**58**	**3.1**	**62**	**3.3**	**63**	**3.4**

* Rates were calculated per 100,000 population using 2010 U.S Census figures for years 2012-2014 and 2015 U.S Census estimate was used for year 2015

Appendix 3 shows the incidence rate of acute confirmed cases of HCV infection in West Virginia during 2012 to 2015

Appendix 4. Cases of Chronic HCV infection by Year of Report, West Virginia – 2012-2015 (n=21,344)

Past/Present Hepatitis C by Year of Report, WV, 2012-2015 * (n=21,344)																	
	2012		2013		2014		2015			2012		2013		2014		2015	
County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	County	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000	Number of Cases	Rate per 100,000
Barbour	23	138.6	47	283.3	82	494.3	65	389.1	Mineral	29	102.8	12	42.5	32	113.4	37	134.8
Berkeley	121	116.2	194	186.2	267	256.3	353	315.5	Mingo	65	242.2	72	268.3	119	443.4	129	510.0
Boone	60	243.6	68	276.1	82	332.9	75	320.9	Monongalia	109	113.3	45	46.8	109	113.3	157	150.6
Braxton	54	371.8	83	571.5	79	544.0	59	409.3	Monroe	22	162.9	16	118.5	38	281.4	37	274.0
Brooke	36	149.6	53	220.2	47	195.3	28	119.9	Morgan	7	39.9	17	96.9	22	125.4	36	205.4
Cabell	238	247.1	414	429.8	615	638.5	426	439.9	Nicholas	79	301.1	75	285.9	103	392.6	95	371.2
Calhoun	4	52.4	5	65.6	10	131.1	13	174.0	Ohio	44	99.0	55	123.8	89	200.3	107	248.5
Clay	17	181.1	20	213.1	38	404.9	41	460.2	Pendleton	6	78.0	14	181.9	5	65.0	6	83.0
Doddridge	14	170.7	22	268.2	25	304.8	34	415.9	Pleasants	14	184.1	19	249.8	11	144.6	37	482.1
Fayette	135	293.2	172	373.6	207	449.6	197	437.8	Pocahontas	17	195.0	10	114.7	24	275.3	24	278.8
Gilmer	10	115.0	9	103.5	107	1230.9	53	622.2	Preston	62	185.0	50	149.2	311	927.8	279	822.0
Grant	19	159.2	14	117.3	30	251.3	9	76.5	Putnam	86	155.0	71	128.0	138	248.7	96	168.9
Greenbrier	124	349.5	105	295.9	218	614.4	248	698.3	Raleigh	368	466.7	411	521.2	536	679.7	526	678.6
Hampshire	21	87.6	18	75.1	54	225.3	41	175.6	Randolph	71	241.5	34	115.6	80	272.1	94	322.7
Hancock	96	312.9	72	234.7	128	417.3	84	281.7	Ritchie	13	124.4	31	296.7	20	191.4	18	180.3
Hardy	15	107.0	11	78.4	31	221.0	21	151.6	Roane	11	73.7	11	73.7	19	127.3	25	173.2
Harrison	132	191.0	98	141.8	116	167.9	143	208.1	Summers	39	280.0	55	394.9	80	574.4	67	506.1
Jackson	29	99.3	35	119.8	42	143.8	56	191.5	Taylor	61	361.1	54	319.6	68	402.5	72	425.7
Jefferson	52	97.2	58	108.4	117	218.7	129	228.4	Tucker	9	126.0	4	56.0	12	168.0	1	14.4
Kanawha	517	267.8	611	316.5	797	412.8	654	347.3	Tyler	7	76.0	10	108.6	10	108.6	13	144.8
Lewis	26	158.8	22	134.4	27	164.9	43	261.4	Upshur	25	103.1	19	78.3	42	173.2	28	113.1
Lincoln	50	230.2	88	405.2	94	432.8	102	476.3	Wayne	48	113.0	65	153.0	109	256.6	171	417.4
Logan	81	220.5	155	421.8	210	571.5	217	625.2	Webster	32	349.6	24	262.2	29	316.8	23	262.7
Marion	89	157.8	45	79.8	80	141.8	80	140.5	Wetzel	21	126.6	25	150.8	23	138.7	20	126.5
Marshall	38	114.8	47	142.0	51	154.0	59	184.5	Wirt	5	87.5	1	17.5	2	35.0	10	170.1
Mason	126	461.1	114	417.2	160	585.6	153	565.9	Wood	92	105.8	126	144.9	139	159.9	199	230.2
McDowell	146	660.2	108	488.4	181	818.5	187	942.8	Wyoming	125	525.3	106	445.5	150	630.4	104	469.5
Mercer	261	419.2	265	425.6	396	636.0	366	598.4	**West Virginia**	**4001**	**215.9**	**4385**	**236.6**	**6611**	**356.8**	**6347**	**344.2**

* Rates were calculated per 100,000 population using 2010 U.S Census figures for years 2012-2014 and 2015 U.S Census estimate was used for year 2015

Appendix 4 shows the rate of past/present HCV rates in 2012, 2013, 2014 and 2015. Some of the cases of past/present HCV have already been reported in HCV registry (surveillance system prior to WVEDSS) in years prior to 2012. Therefore, the rate of past or present HCV is not the incidence rate.

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