Michigan Department of Health & Human Services

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2017 Hepatitis B and C Annual Surveillance Report

Viral Hepatitis Surveillance and Prevention Unit

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Viral Hepatitis Data Summary

Table 1. Summary of Demographic Information by Type of Hepatitis, Michigan, 2017

	Acute Hepatitis B	% Acute Hepatitis B	Chronic Hepatitis B	% Chronic Hepatitis B	Acute Hepatitis C	% Acute Hepatitis C	Chronic Hepatitis C	% Chronic Hepatitis C	MI Population	% MI Population
n	64	100%	1,237	100%	234	100%	12,062	100%	9,928,300	100%
Sex										
Male	38	59%	714	58%	149	64%	6,973	58%	4,883,220	49%
Female	26	41%	522	42%	84	36%	5,054	42%	5,045,080	51%
Unknown	0	0%	1	0%	1	0%	35	0%	0	0%
Race and Ethnicity										
Caucasian	45	73%	340	35%	199	89%	5,977	70%	7,474,930	75%
Black or African American	14	23%	275	28%	14	6%	1,861	22%	1,347,079	14%
Hispanic	1	2%	18	2%	8	4%	231	3%	491,430	5%
Asian	1	2%	246	25%	1	0%	62	1%	291,323	3%
American Indian or Alaskan Native	0	0%	2	0%	1	0%	99	1%	42,919	0%
Other	1	2%	84	9%	1	0%	295	3%	280,619	3%
Unknown	2	-	272	-	10	-	3,537	-	0	-
Age										
Mean	47	-	47	-	34	-	49	-	n/a	-
Median	45	-	47	-	32	-	53	-	40	-
Range	24-84	-	0-93	-	16-79	-	0-103	-	n/a	-
0-19 years	0	0%	34	3%	2	1%	187	2%	2,462,218	25%
20-29 years	6	9%	142	11%	84	36%	1,894	16%	1,360,177	14%
30-39 years	15	23%	268	22%	86	37%	2,106	17%	1,181,468	12%
40-49 years	20	31%	246	20%	32	14%	1,263	10%	1,221,181	12%
50-59 years	9	14%	239	19%	19	8%	2,596	22%	1,429,675	14%
60+ years	14	22%	308	25%	11	5%	4,005	33%	2,273,581	23%
Unknown	0	0%	0	0%	0	0%	11	0%	0	0%

*Other MI population Includes 2016 census estimates of "some other race" and "two or more races"

The summary table above was created to illustrate the differences in the demographic make-up between the various viral hepatitis classifications. For instance, males were more likely to have had a diagnosis of all viral hepatitis classifications in 2017. There are some notable racial differences among reported hepatitis cases. Asians had a higher proportion of acute and chronic hepatitis B diagnosis than acute or chronic hepatitis C. Caucasians comprise a large majority of the acute hepatitis C cases, accounting for approximately 89% of cases reported with a known race. While they make up a minority of all cases, it should be noted that American Indians and Alaskan Natives are more likely to have a hepatitis C diagnosis than a hepatitis B diagnosis. The mean age for cases of acute hepatitis C is lower in comparison to the other viral hepatitis case classifications. More detailed information on each viral hepatitis case classification can be found in subsequent sections of this report.

This report presents hepatitis B and C data collected from case reports submitted to the Michigan Disease Surveillance System (MDSS) for calendar year 2017. Performing surveillance for viral hepatitis infections is important for identifying trends in rates of infection, characterizing at-risk groups, evaluating prevention programs, and identifying outbreaks. Below is a summary of the key findings from this year's report for the various hepatitis B and C case classifications, special populations, and hepatitis-related health outcomes.

Acute Hepatitis B

- There were 64 cases of acute hepatitis B infection reported in Michigan in 2017 for a rate of 0.64 cases per 100,000 people. This is below the most recent national rate of acute HBV infection (1.00 per 100,000).
- Case follow-up and completion of epidemiological risk factors was completed for 98% of acute hepatitis B cases in 2017.
- Use of injection street drugs was the most commonly reported risk factor among 2017 acute hepatitis B cases.

Chronic Hepatitis B

- There were 1,237 new chronic hepatitis B diagnoses reported in Michigan in 2017 for a rate of 12.46 cases per 100,000 people.
- Males have shown higher rates of Chronic Hepatitis B than females since 2004.
- Asians are disproportionately affected by chronic hepatitis B with an infection rate of 84.44 per 100,000, compared to the state average of 12.46.

Acute Hepatitis C

- There were 234 cases of acute hepatitis C reported in Michigan in 2017 for a rate of 2.36 cases per 100,000 people. This is higher than rates reported from Michigan in 2016 (1.55) and the national acute HCV rate of 1.00 cases per 100,000 reported in 2016.
- The average age of acute hepatitis C cases, 37 years old, was much younger than the other hepatitis case classifications.
- Case follow-up and completion of epidemiological risk factors was completed for about 94% of acute hepatitis C cases in 2017.
    - Where data were available, injection drug use was reported by 65% of acute hepatitis C cases.

Chronic Hepatitis C

- There were 12,062 new chronic hepatitis C diagnoses reported in Michigan in 2017 for a rate of 121.49 cases per 100,000 people.
- The rate of chronic hepatitis C is higher in Michigan males (142.8 per 100,000) versus females (100.18 per 100,000).
- American Indians and Alaskan Natives (230.67 per 100,000) have a higher rate of chronic hepatitis C infection than the general Michigan population.
- Case follow-up and completion of epidemiological risk factors was completed for about 57% of chronic hepatitis C cases in 2017.
    - Where data were available, injection drug use was a factor shared by 64% of cases. Incarceration was a risk factor in 63% of cases.
- Where data were available, 78% of chronic hepatitis C cases were reported with genotype 1 infection, 14% with genotype 3, and 8% with genotype 2.

Special Populations

Hepatitis C in Young Adults

- From 2005 through 2017, the number of cases of chronic hepatitis C among persons aged 18 -29 years has increased over 476% from 359 cases to 2,069.
- A concurrent signal of increased heroin abuse has been evident within the same timeframe.
    - Injection drug use in 18-29 year olds was reported in 85% of hepatitis C patients.
    - Between 2000 and 2017 there has been a 177% increase in Michigan heroin substance abuse treatment admissions.
    - From 2000 through 2016 heroin overdose deaths in Michigan have increased by 722%
- The opioid epidemic is impacted both young males and females. As a result we have seen 20 cases of perinatal hepatitis C as a result of mother-to-child transmission over the last 5 years, and a rate of 761.2 instances of treated neonatal abstinence syndrome (NAS) per 100,000 live births in 2016.

Viral Hepatitis and Human Immunodeficiency Virus (HIV) Co-infection

- From 2004-2017, there were 816 persons in Michigan reported with Hepatitis B/HIV co-infection.
    - 89.1% of these persons are male.
    - The primary modes of HIV transmission in the HIV/HBV co-infection group were men who have sex with men (MSM) at 60.2%
- From 2004-2016, there were 1,556 persons in Michigan reported with Hepatitis C/HIV co-infection.
    - 73.3% of these persons are male.
    - The primary modes of HIV transmission in the HIV/HCV co-infection group were IDU at 40.9% and MSM at 23.4%
- Incidence of HBV/HIV co-infections has continued to decline. As a result of better HIV linkage to care and treatment, these individuals are living longer lives and thus prevalence of both HBV/HIV coinfection and HCV/HIV coinfection are increasing.
- Incidence of HIV/HCV coinfection has increased in recent years, likely due, in part, to the change in HCV case definition that was implemented in 2016.

Viral Hepatitis Outcomes

Hospitalization Data

- Hospitalizations attributed to hepatitis C increased by nearly 46% from 2005 through 2016, while total hospitalizations due to hepatitis B and HIV each decreased slightly.

Transplant Data

- Trends in liver transplantation may be indicative of increasing disease progression and morbidity associated with long-term HBV and/or HCV carriage.

Viral Hepatitis and Liver Cancer

- The overall incidence for liver cancer in Michigan has increased by 46% between 2004 and 2015.
- The liver cancer rate among African American males (19.2 cases per 100,000) is more than twice that among Caucasian males (8.5 cases per 100,000).
- The overall liver cancer mortality has increased by 64% between 2004 and 2016 in Michigan.
- In 2016, the Michigan liver cancer mortality rate higher in African-American males(7.8 per 100,000) than it was in Caucasian males (5.6 per 100,000).

Viral Hepatitis-Related Mortality

- There were 146 deaths attributed to chronic hepatitis C in Michigan in 2016.
- Deaths due to chronic hepatitis C alone increased by 57% between 2003 and 2016.

Background and Technical Notes

INTRODUCTION

The Michigan Department of Health and Human Services (MDHHS) requires medical providers and laboratories to report cases of communicable diseases, including viral hepatitis, in accordance with Michigan's Communicable Disease Rules. Cases are reported to MDHHS via the Michigan Disease Surveillance System (MDSS), a web-based communicable disease reporting system developed for the state of Michigan. Providers and laboratories can enter cases manually or send cases via HL7 electronic laboratory report (ELR). The MDSS is compliant with CDC's National Notifiable Disease Surveillance System (NNDSS) and has been in use in Michigan since 2004. Case reporting is accomplished in MDSS via standard HTML demographic data collection fields with an enhanced viral hepatitis reporting form for disease-specific data. While acute hepatitis A, acute hepatitis B, acute hepatitis C, chronic hepatitis B, chronic hepatitis C, perinatal hepatitis B, hepatitis D and hepatitis E are all reported in MDSS, this report will primarily highlight acute, chronic, and perinatal hepatitis B and C surveillance, along with updates regarding hepatitis A and populations of higher risk. MDHHS follows the current CDC Guidelines for Viral Hepatitis Surveillance and Case Management for reporting, investigating, and maintaining quality assurance in viral hepatitis surveillance. Viral hepatitis surveillance data is submitted to CDC weekly in accordance with Morbidity and Mortality Weekly Report (MMWR) notification standards. Cases are classified according to the most recently published CDC/CSTE case definitions.

BACKGROUND

"Hepatitis" means inflammation of the liver and can stem from both infectious and non-infectious causes. The most common types of viral hepatitis are hepatitis A (HAV), hepatitis B (HBV), and hepatitis C (HCV). These viruses can produce an acute illness characterized by nausea, malaise, abdominal pain, and jaundice, although many of these acute infections are asymptomatic or cause only mild disease. HAV is transmitted from person to person via ingestion of food and water contaminated with human waste while HBV and HCV are both blood borne pathogens. Many persons infected with HBV or HCV are unaware they are infected. Unlike HAV, both HBV and HCV can produce chronic infections that often remain clinically silent for decades while increasing the risk for liver disease and hepatocellular carcinoma. Viral hepatitis is the leading cause of liver cancer and the most common reason for liver transplantation in the United States. An estimated 4.4 million Americans are living with chronic hepatitis; most do not know they are infected due to the often asymptomatic nature of chronic infections.

Hepatitis A Virus

Hepatitis A is a liver disease caused by HAV. Hepatitis A can affect anyone, and the virus is spread through contaminated food or water and close contact with persons who are infected. Frequent hand washing with soap and warm water after using the bathroom, changing a diaper, or before preparing food can help prevent the spread of HAV, but the best form of protection is the hepatitis A vaccine.

Hepatitis B Virus

HBV is transmitted through contact with the blood or body fluids of an infected person, most often through sharing infected injection-drug use equipment, from sexual contact with an infected person, or from an infected mother to her newborn during childbirth. Transmission of HBV also can occur among persons who have prolonged contact with someone who is HBV-infected (e.g., household contacts). Most people do not experience any symptoms during the acute infection phase. However, some people have acute illness with symptoms that last several weeks, including jaundice, dark urine, extreme fatigue, nausea, vomiting and abdominal pain. In some people, the hepatitis B virus can also cause a chronic liver infection that can later develop into cirrhosis of the liver or liver cancer.

The risk for chronic HBV infection decreases with increasing age at infection. Among infants who acquire HBV infection from their mothers at birth, as many as 90% become chronically infected, whereas 30%–50% of children infected at age 1–5 years become chronically infected. This percentage is smaller among adults, in whom approximately 5% of all acute HBV infections progress to chronic infection.

In the United States, 850,000-2.2 million persons are estimated to be infected with the virus, most of whom are unaware of their infection status. Worldwide, more than 240 million people have chronic HBV infection and about 600,000 people die every year due to the acute or chronic consequences.

Effective hepatitis B vaccines have been available in the United States since 1981 and the CDC recommends vaccination of all infants at birth. Several oral drugs are

now available, leading to viral suppression in 90% of patients taking one of these new oral medications.

Hepatitis C Virus

HCV is transmitted primarily through exposure to infected blood, which can result from sharing infected injection-drug use equipment, needle-stick injuries involving contaminated blood, receipt of blood or blood products before the availability of a standard screening test in 1992 and inadequate infection control in health-care settings. Much less often, HCV transmission occurs among infants born to HCV-infected mothers or during sexual contact. HCV is not spread by sneezing, coughing, or kissing. The best way to prevent HCV infection is by avoiding behaviors that can spread the disease, especially sharing injection drug use works.

The incubation period for HCV is 2 weeks to 6 months. Following initial infection, approximately 80% of people do not exhibit any symptoms. Those who are symptomatic may experience fever, fatigue, decreased appetite, nausea, vomiting, abdominal pain, dark urine, and jaundice. No laboratory distinction can be made between acute and chronic HCV infection. Diagnosis of chronic infection is made on the basis of anti-HCV positive results upon repeat testing and the presence of HCV in the blood. About 75–85 % of newly infected persons develop chronic infection and 60–70% of chronically infected people develop chronic liver disease; 5–20% of chronically infected people develop cirrhosis and 1–5% die from cirrhosis or liver cancer.

With an estimated 3.5 million chronically infected persons nationwide, HCV infection is the most common blood-borne infection in the United States. Worldwide, about 150 million people are chronically infected with HCV, and more than 350,000 people die every year from HCV-related liver diseases.

Since no vaccine is available for preventing HCV infection, other prevention activities, such as not sharing infected injection drug equipment and consistently implementing and practicing infection control in health-care settings, are vital. Linkage to care and treatment is critical to improving health outcomes for persons found to be infected with HCV. Such linkage is particularly important in light of the major advancements that have been made in treatment of hepatitis C. New HCV direct acting antivirals have few side effects and contraindications and can clear HCV infection in 8-24 weeks with a success rate of 90-95%.

TECHNICAL NOTES

Michigan Communicable Disease Reporting Requirements

Michigan's communicable disease rules are promulgated under the authority conferred on the Department of Health and Human Services by Section 5111 of Act No. 368 of the Public Health Acts 1978, as amended, being 333.5111 of the Michigan Compiled Laws. MDHHS maintains a list of conditions, including viral hepatitis, which must be reported by physicians, other authorized health care professionals and laboratories to the local health department in which the patient resides.

Michigan is a "home rule state," in which local governments have direct control over local health departments (LHD). Therefore, LHDs function as administratively autonomous units, separate from MDHHS. MDHHS provides administration of MDSS, expert consultation and other support as needed to LHDs. Physicians and laboratories report diseases to LHDs, who have authority to investigate and follow-up on the case in accordance with their own priorities and available resources.

Michigan has adopted standardized case definitions for HAV, HIV, perinatal HBV, and acute and chronic hepatitis B and C, which were developed and approved by the Council of State and Territorial Epidemiologists and CDC (see Page 11). Cases of acute and chronic hepatitis B and C are reported via MDSS using standardized CDC case report forms (see page 11).

Michigan Disease Surveillance System

Mandatory reporting of communicable diseases can be accomplished via the Michigan Disease Surveillance System (MDSS). The MDSS is a web-based communicable disease reporting system developed for the State of Michigan. The MDSS facilitates coordination among local health departments, MDHHS and federal public health agencies. MDSS provides for the secure transfer, maintenance and analysis of communicable disease surveillance information. MDSS has the capability to receive electronic laboratory reports directly from laboratories via HL7 messaging. Alternatively, cases can be manually entered into MDSS via the web portal by medical providers, laboratories or local health department staff. Cases that have been previously entered in MDSS are matched with incoming cases by a process known as deduplication. The MDSS deduplicates both the client and the disease event based on an

algorithm of name, sex, and date of birth. Case reporting is accomplished in MDSS via standard HTML demographic data collection fields with an enhanced viral hepatitis reporting form for disease-specific data. MDHHS submits weekly de-identified individual case reports to CDC via the National Notifiable Disease Surveillance System Modernization Initiative, a computerized public health surveillance information system.

The data in this report includes all cases which meet the CDC/CSTE case definitions referenced in "Web Links to Case Definitions and Case Report Forms" on page 11. Data includes cases with referral dates between January 1, 2017 and December 31, 2017 in MDSS.

Local Health Jurisdiction Structure

The state of Michigan is divided into eight public health preparedness regions that are serviced by 45 health jurisdictions comprised of 84 counties. These local health departments, functioning as administratively autonomous units, provide basic public health services, including communicable disease-related services, to all Michigan citizens and health care providers. The MDHHS provides expert consultation, reference level diagnostic laboratory services, and support to local health departments. MDHHS's public health laboratory performs hepatitis serologic and molecular testing for public health partners.

Determination of Rates

When calculating rates for years prior to 2010, 2000 Michigan Census data was used. 2010 Census data was used for rates in the years 2010 - 2015. The U.S. Census Bureau's American Communities Survey (ACS) 1-year population estimates for 2016 was used to calculate rates in 2017. All rates were calculated per 100,000 persons in the Michigan population. Michigan Census data used in the annual report can be found at:

http://www.michigan.gov/cgi/0,4548,7-158-54534-252541--,00.html

National Benchmarks

References to national benchmarks come from CDC Division of Viral Hepatitis statistics via the National Notifiable Disease Surveillance System (NNDSS). National statistics used in the annual report can be found at:
http://www.cdc.gov/hepatitis/Statistics/index.htm

Data Limitations

There are several limitations to the data presented in this report. As a result, conclusions drawn from the data in this report should be interpreted with caution and with the appropriate recognition of these limitations. As described earlier, this report compiles data on new viral hepatitis diagnoses, which meet CDC/CSTE case definitions, reported to the MDSS in the year 2017. In general, this is not necessarily reflective of the true number of new infections that occurred in 2017 nor the total number of individuals infected with viral hepatitis currently living in Michigan. Rather, these numbers are a rough approximation of the number of new viral hepatitis diagnoses for the year. This should not, however, imply that these infections were contracted in the year 2017. Since the majority of newly diagnosed viral hepatitis infections are chronic in nature, our data has limited utility in deciphering the date of exposure or infection acquisition for these cases.

New case definitions for acute and chronic hepatitis C cases were adopted in 2016. This definition lowers the threshold for inclusion as a case (see page 11). As a result, increases in HCV case counts and rates since 2015 may be, at least in part, indicative of the change in case counting methodology.

Like many reportable diseases, cases of viral hepatitis are largely under-reported. CDC estimates suggest that only about 8-10% of acute HBV and 15-17% of acute HCV cases are reported each year. This is mainly due to the infections resulting in subclinical disease in the majority of individuals. Most viral hepatitis infections are asymptomatic and thus the infected person never seeks medical care and is not aware of their infection status until symptoms of the chronic infection develop later on in life. Indeed, it is estimated that up to 75% of individuals infected with HCV do not know they are infected. CDC data approximates that, nationwide, 850,000 individuals (about 0.3% of the US population) and 3.5 million (about 1% of the US population) are infected with HBV and HCV respectively. Extrapolating that to the Michigan population, we would then expect approximately 26,000 Michiganders to be infected and living with HBV and 108,000 with HCV.

It should be noted that individuals who clear their HCV infection spontaneously (in about 25% of those exposed to the virus) or via antiviral treatment are still counted as cases in our disease surveillance system and are not removed from our case counts. Also, individuals who are

repeatedly infected with HCV are only counted once in their lifetime in our surveillance system.

The Michigan Department of Corrections (MDOC) conducts HCV screening for new inmates and they report cases to the MDSS as with any provider. Inmates who are positive for HCV are entered into MDSS and are counted in the county where their correctional facility is located. All MDOC cases are removed from LHD case counts.

Enhanced Viral Hepatitis Surveillance, 2013-current

Starting in 2013 the Viral Hepatitis Unit initiated a plan to improve viral hepatitis surveillance in Michigan. New surveillance activities in this plan included: additional deduplication of cases in MDSS, active surveillance of cases of public health importance, recruitment of laboratories to report into MDSS electronically, and enhanced auditing and quality assurance of acute and chronic viral hepatitis cases. These enhancements to routine surveillance activities resulted in more reliable and complete information on viral hepatitis diagnoses. Large discrepancies in the data between 2013 and prior years may be a result of these enhanced surveillance efforts and not necessarily indicative of true disease trends.

National Notifiable Disease Surveillance System Case Definitions

- Hepatitis A
- Perinatal Hepatitis B
- Acute Hepatitis B
- Chronic Hepatitis B
- Acute Hepatitis C, 2016
- Chronic Hepatitis C, 2016

Michigan Viral Hepatitis Case Report Forms

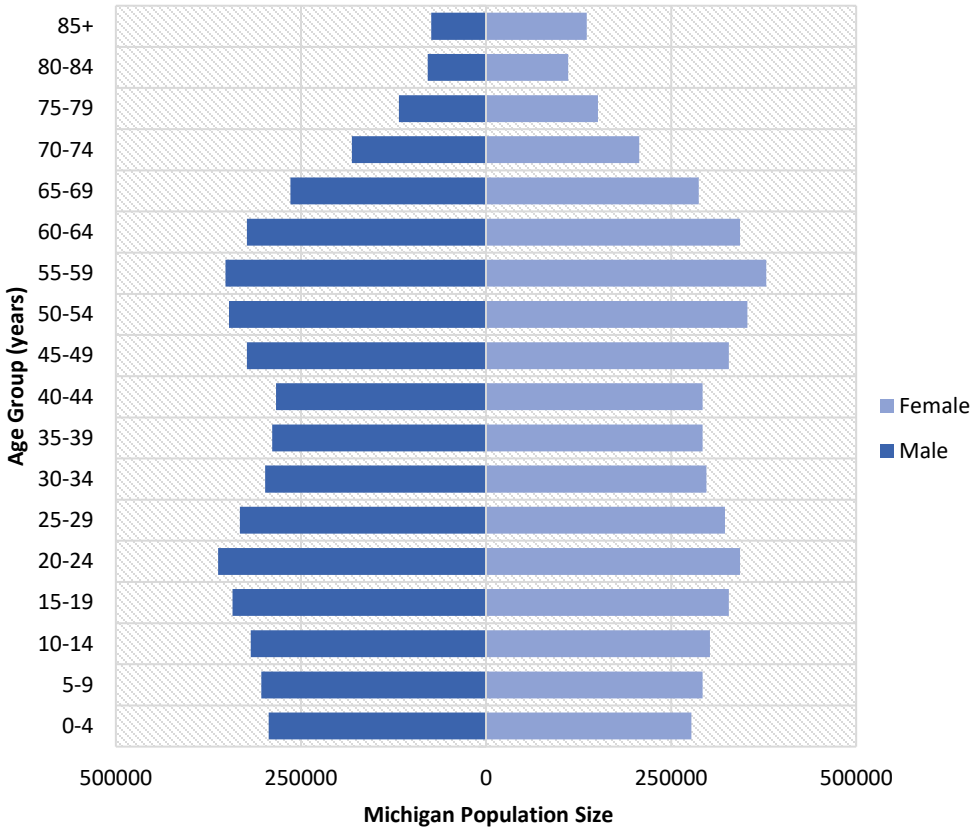
- Hepatitis A
- Perinatal Hepatitis B
- Acute Hepatitis B
- Chronic Hepatitis B
- Acute Hepatitis C
- Chronic Hepatitis C

Web Links to Case Definitions and Case Report Forms

Michigan Census and Demographics

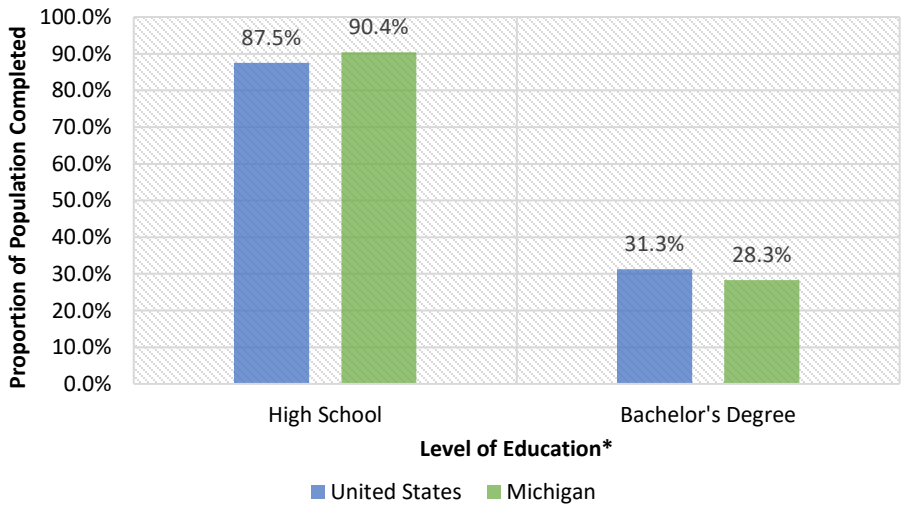
Population by Age, Gender & Education

Figure 1.1 Age and sex: Michigan, 2016



In 2016, the Michigan population was 9,928,300; the 10th most populous state in the United States. Persons born between 1945 through 1965, amounted to 2,752,945 persons or 28 percent of the total population. Females and males made up approximately the same proportion, but there was a notably higher percentage of females than males among the older population (75+ years old). About 78% of the total population was greater than eighteen years old, and residents greater than age sixty-five comprised 16% of the total population. The median age was forty years old.

Figure 1.2 Level of education: Michigan and the U.S., 2016



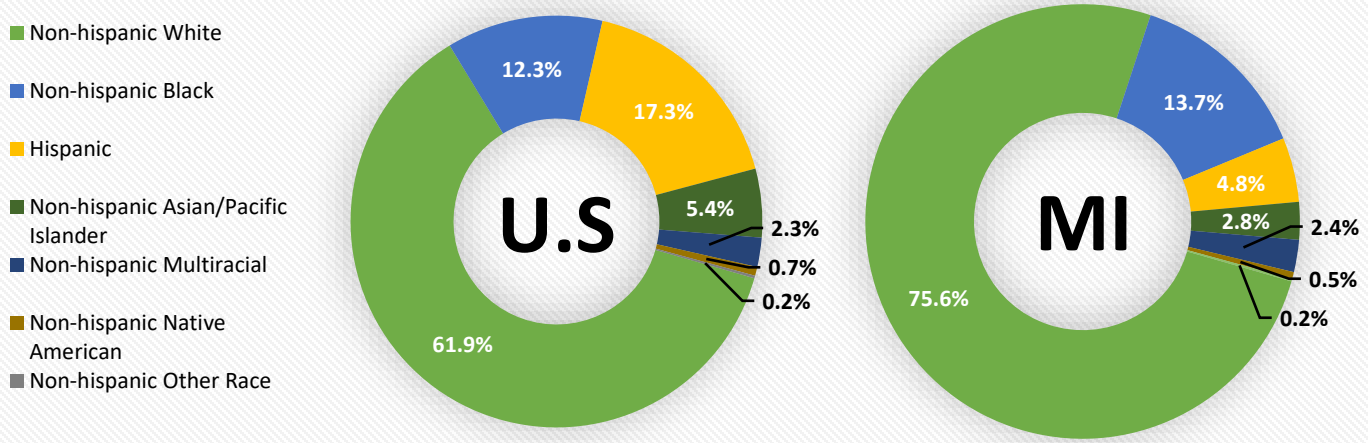
Looking at those aged twenty-five years and older, 90.4% of Michigan's population completed high school, more than the national benchmark at 87.5%. A higher percentage of the national population, however, completed a Bachelor's degree than did those from the state of Michigan.

*Individuals who completed some college but did not finish a degree are still noted as high school graduates. Those considered to have completed a Bachelor's degree include persons who finished any type of education higher than a Bachelor's degree.

Source: The United States Census Bureau

Population by Race & Ethnicity

Figure 1.3 Race and Ethnicity: Michigan and U.S., 2016



According to the 2016 ACS estimates, the racial and ethnic composition of Michigan is 75.6 percent non-Hispanic white; 13.7 percent black; 4.8 percent Hispanic; 2.8 percent non-Hispanic Asian alone; 2.6 percent multiracial or other race. Nationally, the population of non-Hispanic white is 61.9 percent of the total, and the Hispanic population is 17.3 percent. The proportion of male and females within each racial/ethnic group is similar. Between 2010 and 2016, there was a 23.1% rise in Michigan's Asian/ Pacific Islander population and a 55.27% rise in Michigan individuals with some other race classification.

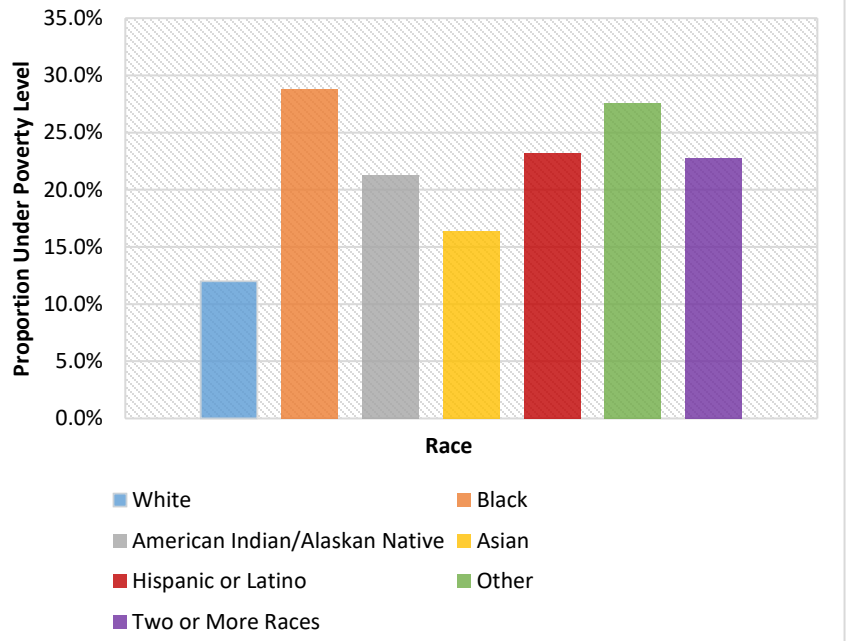
Table 1.1 Population by Race: Michigan, 2010-2016

	2010 Census		2016 ACS		2010-2016	
Race	**Population Count**	**Percent of Total**	**Population Count**	**Percent of Total**	**Change**	**Percent Change**
Total Population	9,883,640	100.00%	9,928,300	100.00%	44,660	0.45%
White Alone	7,569,939	76.59%	7,474,930	75.29%	-95,009	-1.26%
Black Alone	1,383,756	14.00%	1,347,079	13.57%	-36,677	-2.65%
Hispanic	436,358	4.41%	491,430	4.95%	55,072	12.62%
Asian/ Pacific Islander Alone	238,660	2.41%	293,785	2.96%	55,125	23.10%
Multiracial	190,396	1.93%	262,838	2.65%	72,442	38.05%
Native American Alone	54,665	0.55%	42,919	0.43%	-11,746	-21.49%
Other Race Alone	9,866	0.10%	15,319	0.15%	5,453	55.27%

Source: The United States Census Bureau

Poverty, Income & Health Insurance

Figure 1.4 Population under the poverty line by race: Michigan, 2016



The poverty line is determined at a national level each year. In 2016 a family of four would be considered in poverty if the household income in the past twelve months was under $24,000. The Black or African American community in Michigan had the highest rate of poverty in 2016 (28.8%), with over 400,000 individuals in poverty. The white population had the lowest percentage of poverty (12.0%) but the largest number of impoverished individuals (over 900,000). The American Indian/Alaskan Native and Hispanic/Latino populations, along with the multiracial population, showed similar percentages under the poverty line (about 21-23%).

In 2016, about 95% of Michigan's population was covered by public or private insurance, which was slightly higher than the U.S. population (91%). Consequently, the uninsured proportion of Michigan's population was smaller than the national proportion.

Figure 1.5 Health insurance coverage, Michigan and the U.S., 2016

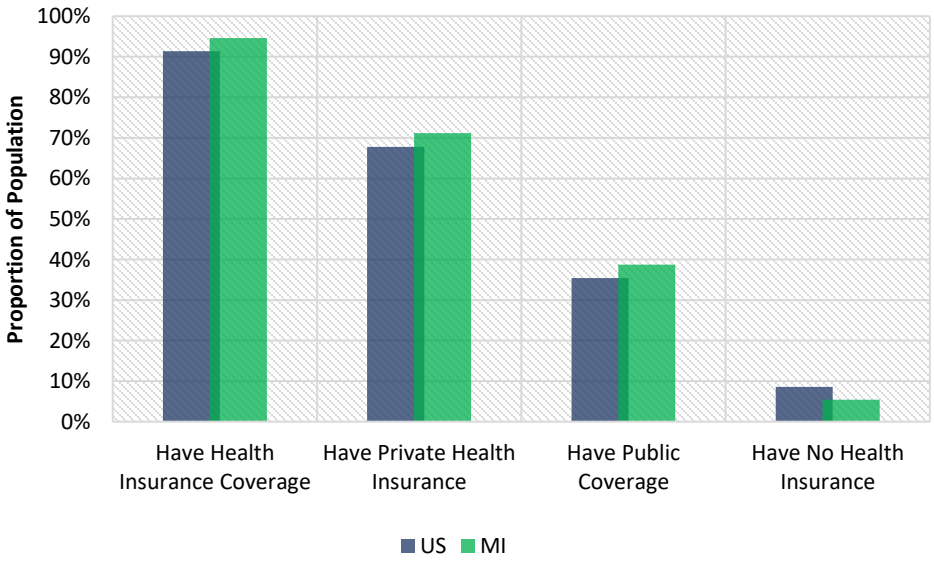
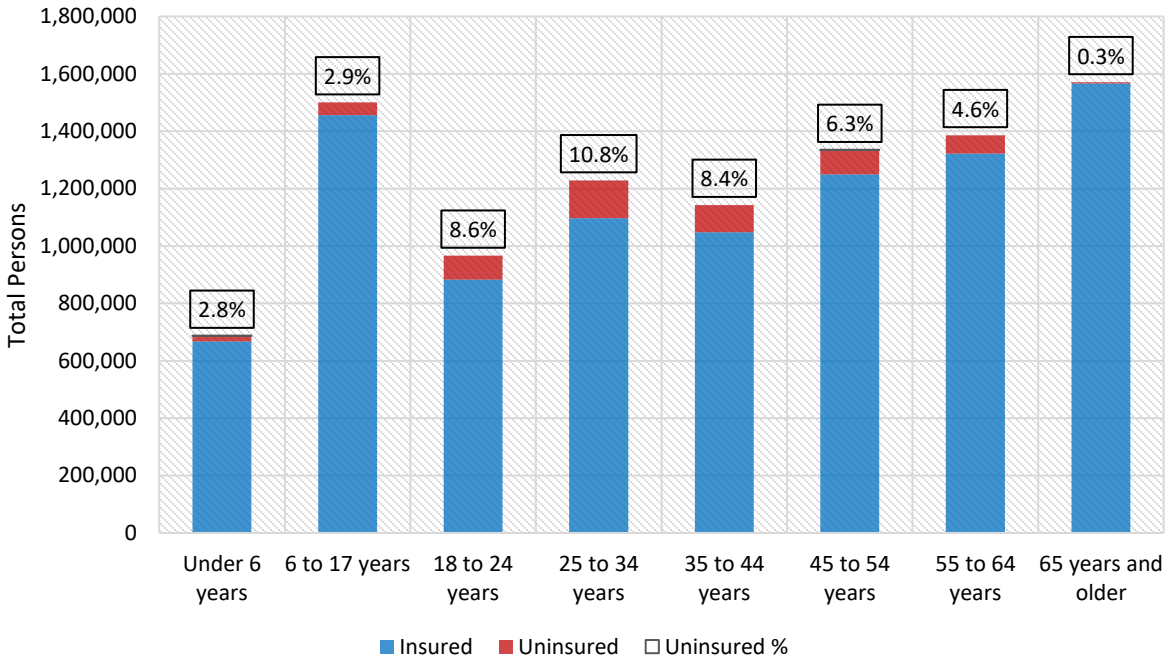
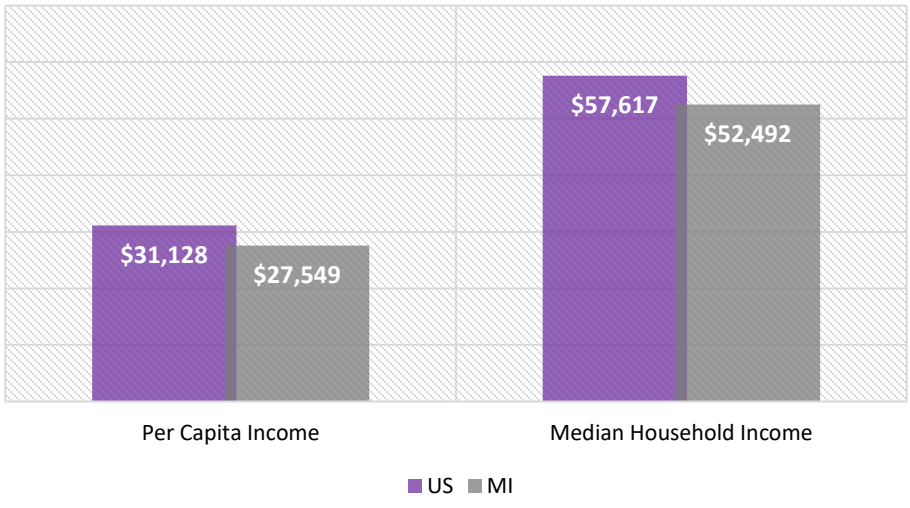


Figure 1.6 Michigan Population by Age Group, Proportion Insured, and Percent Uninsured, 2016



As estimated by the U.S. Census, the most populous age group in Michigan is aged 65 years and older, with approximately 1.57 million individuals. That group, along with the 6 to 17-year-old populations, are all estimated to have insurance coverage of 97% or higher. In contrast, the young adult and middle-aged Michiganders are more likely to be uninsured. The 25 to 34-year-old population was estimated to have the largest proportion of uninsured individuals (10.8%), followed by the 18 to 24-year-old (8.6%) and 35 to 44-year-old (8.4%) cohorts.

Figure 1.7 Income: Michigan and the U.S., 2016



The Michigan population had lower levels of income than that of the U.S. population. The average per capita income for Michigan ($27,549) was 13% lower than the U.S. average ($31,128), and the median household income for Michigan ($52,492) was approximately 10% below the national median ($57,617).

Hepatitis A

Since August 1, 2016, a large ongoing outbreak of hepatitis A virus has taken place in Michigan, affecting more than 600 people in 2017 alone.

While many infected individuals live in Southeast Michigan, hepatitis A has spread throughout other parts of the state. Many instances of hepatitis A infection have caused severe illness, with most resulting in hospital admission and some deaths.

Acute Hepatitis A Outbreak Cases

- There were 632 new acute hepatitis A diagnoses reported in Michigan in 2017 for a rate of 6.39 cases per 100,000 people.
- Males have shown higher rates of Acute Hepatitis A than females during the outbreak.
- The average age of acute hepatitis A cases was 43 years old.
- Case follow-up and completion of epidemiological risk factors was completed for about 80% of acute hepatitis A cases.
- Where data were available, 69% of acute hepatitis A cases were reported with the outbreak genotype 1B.

Hepatitis A in High Risk Populations

During this outbreak people who are more likely to be infected include, individuals who use drugs (injection, non-injection, or marijuana), currently homeless or in transient living, have sex with an infected person, recently in jail or prison, and have an underlying liver disease (e.g. cirrhosis, hepatitis B, or hepatitis C).

- Where data were available on acute HAV cases:
  - Substance use disorder was reported by 287 (45%) individuals
  - Homeless or transient living was reported by 73 (12%) individuals
  - 61 (15%) men reported having sex with other men (Includes only male cases)
  - Recently incarceration was reported by 48 (8%) individuals
  - Underlying liver disease (e.g. HCV, HBV) was reported by 181 (29%) individuals

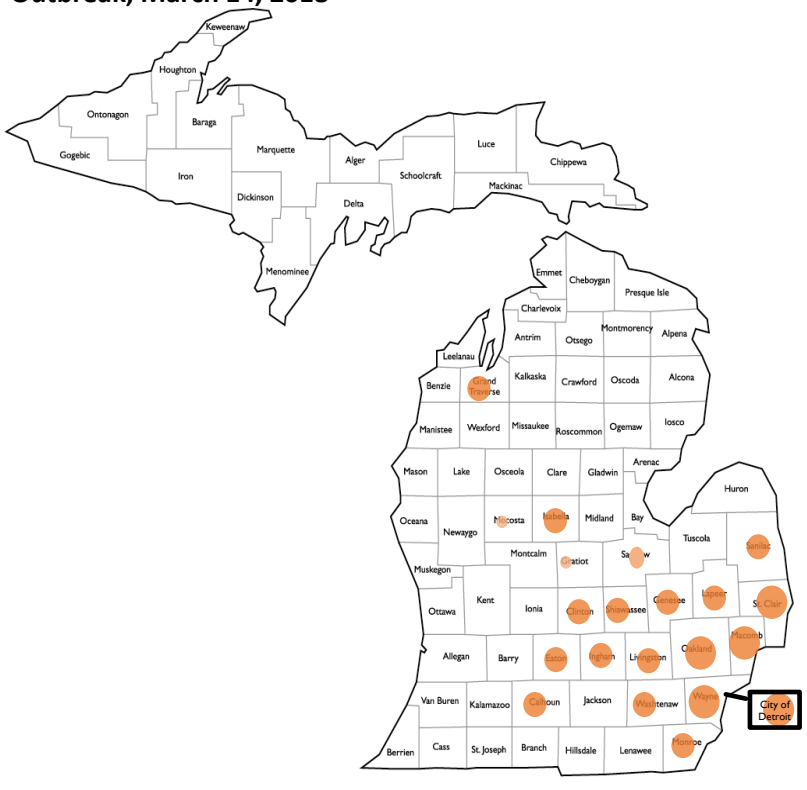
Viral Hepatitis Outcomes

- 20 (3%) deaths have been attributed to the acute hepatitis A outbreak in Michigan in 2017.
- There have also been 508 (80%) hospitalizations attributed to acute hepatitis A outbreak.

Table 2.1 Summary of Demographic Information During the Hepatitis A Outbreak, Michigan, 2017

	Acute Hepatitis A	% Acute Hepatitis A
N= 632		
Sex		
Male	412	65%
Female	220	35%
Age		
Mean	43	
Median	40	
Range	<1-90	
0-19	6	1%
20-29	114	18%
30-39	177	28%
40-49	130	21%
50-59	115	18%
60+ years	90	14%

Figure 2.1 Michigan Counties Included in the Hepatitis A Outbreak, March 14, 2018



Acute Hepatitis B

Acute Hepatitis B—Incidence and Gender

Figure 3.1 Incidence of Acute Hepatitis B in Michigan and United States, 2012-2017

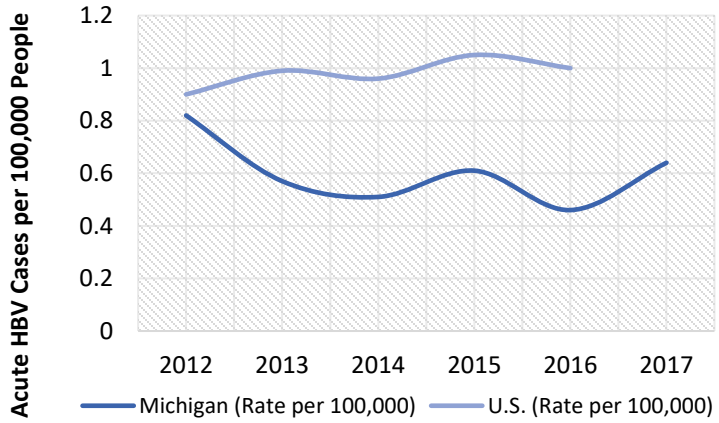


Table 3.1 Incidence of Acute Hepatitis B, Michigan and United States, 2012-2017

Year	Michigan Cases	Michigan (Rate per 100,000)	U.S. (Rate per 100,000)
2012	81	0.82	0.90
2013	56	0.57	0.99
2014	50	0.51	0.96
2015	61	0.61	1.05
2016	46	0.46	1.00
2017	64	0.64	N/A

Following a dip in the incidence rate of acute HBV infections in 2016, incidence has increased in Michigan in 2017. The increase in acute HBV cases may be related to an increase in opioid drug use in Michigan and a concurrent increase in HCV cases, due to sharing infected needles and drug works between people who inject drugs. More specifically, reported injection drug use in cases of acute HBV rose from 9%, where available, in 2016 to 26% in 2017.

Figure 3.2 Number of Acute Hepatitis B Cases by Gender in Michigan, 2012-2017

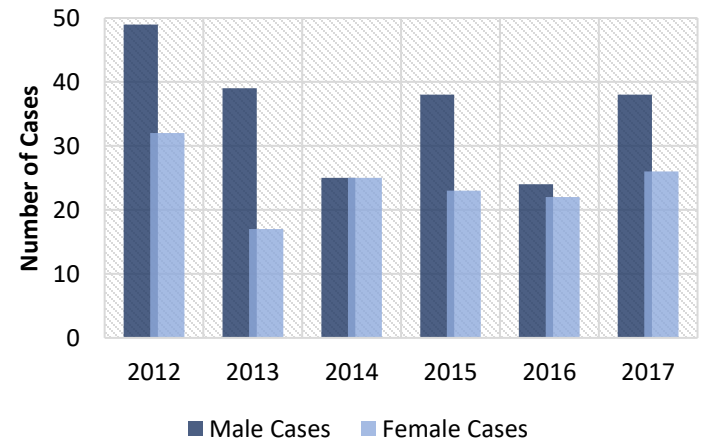


Table 3.2 Acute Hepatitis B Total Cases and Incidence Rate by Gender in Michigan, 2012-2017

Year	Male Cases	Male Incidence	Female Cases	Female Incidence
2012	49	1.01	32	0.64
2013	39	0.80	17	0.34
2014	25	0.52	25	0.50
2015	38	0.78	23	0.46
2016	24	0.49	22	0.44
2017	38	0.78	26	0.52

There was an increase in acute HBV infections in both males and females in 2017. Males have traditionally had a higher rate of acute HBV infections when compared to females, and that trend continued .

Acute Hepatitis B—Race and Ethnicity

Figure 3.3 Incidence of Acute Hepatitis B by Race in Michigan, 2012-2017

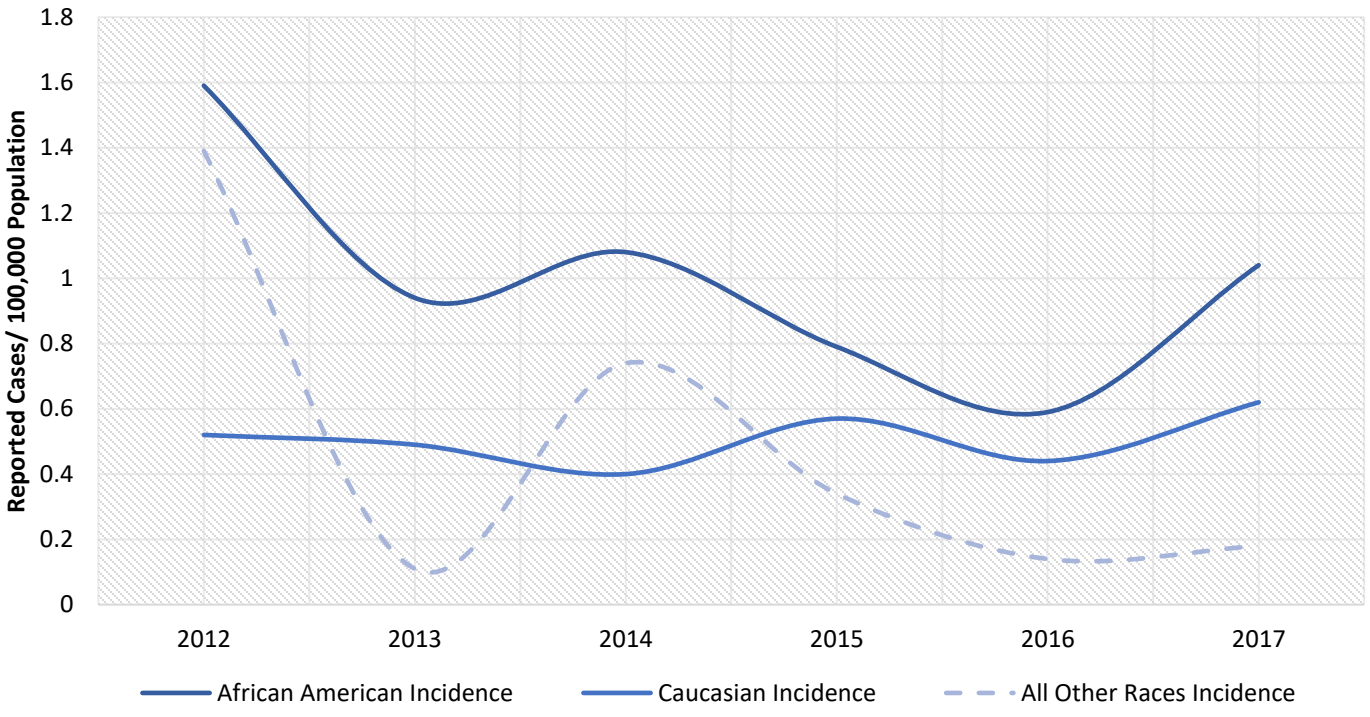


Table 3.3 Incidence of Acute Hepatitis B by Race and Ethnicity in Michigan, 2012-2017

Year	African American Cases	African American Incidence	American Indian or Alaskan Native Cases	American Indian or Alaskan Native Incidence	Asian Cases	Asian Incidence	Caucasian Cases	Caucasian Incidence	Hispanic Cases	Hispanic Incidence	Other Cases	Other Incidence
2012	22	1.59	1	1.83	6	2.54	39	0.52	3	0.69	1	0.49
2013	13	0.94	0	0.00	0	0.00	37	0.49	2	0.46	0	0.00
2014	15	1.08	1	1.83	1	0.42	30	0.40	1	0.23	1	0.49
2015	11	0.79	0	0.00	2	0.85	43	0.57	0	0.00	1	0.49
2016	8	0.59	0	0.00	1	0.34	33	0.44	1	0.21	0	0.00
2017	14	1.04	0	0.00	1	0.34	45	0.62	1	0.20	1	0.36

In 2017, African Americans had the greatest incidence of acute HBV in Michigan. Since 2012, incidence of acute HBV had been decreasing in all races/ethnic groups. However, in 2017, the incidence rate has increased noticeably in African Americans and Caucasians. The rate of acute HBV was lowest for American Indian or Alaskan Natives

In 2016 we switched from using the 2010 Census to using 2015 Census estimates for calculation of infection rates, thus explaining disproportionate changes in incidence rates relative to changes in case counts that may occur throughout this report.

Acute Hepatitis B—Risk Behaviors

Table 3.4a Completeness of Acute Hepatitis B Reports by Risk Behavior in Michigan, 2017 (n = 64)

Risk Behavior	Completed
Injection Drug User	95%
Used Street Drugs	92%
Hemodialysis	97%
Received Blood Products	97%
Received a Tattoo	97%
Accidental Needle Stick	97%
Contact of Person with Hepatitis B	98%
Other Surgery	88%
Oral Surgery or Dental Work	97%
Employed in Medical Field	97%
Employed as Public Safety Officer	95%
Incarceration Longer than 6 Months	97%
Any Part of Body Pierced (other than ear)	97%

Table 3.4a shows the percentage of acute HBV risk behavior questions that were completed by local health department disease investigators in the MDSS case report form. A risk behavior was considered completed if the question was marked as 'Yes', 'No', or 'Unknown'. Acute HBV epidemiologic information questions were completed for approximately 96% of case reports. This is an increase from the 70% of acute HBV questions completed in the year 2012 before enhanced viral hepatitis surveillance funding and similar to case follow-up rates reported in 2016 (93%). According to the CDC, the national average for completeness of acute HBV case report forms was 58% in 2014.

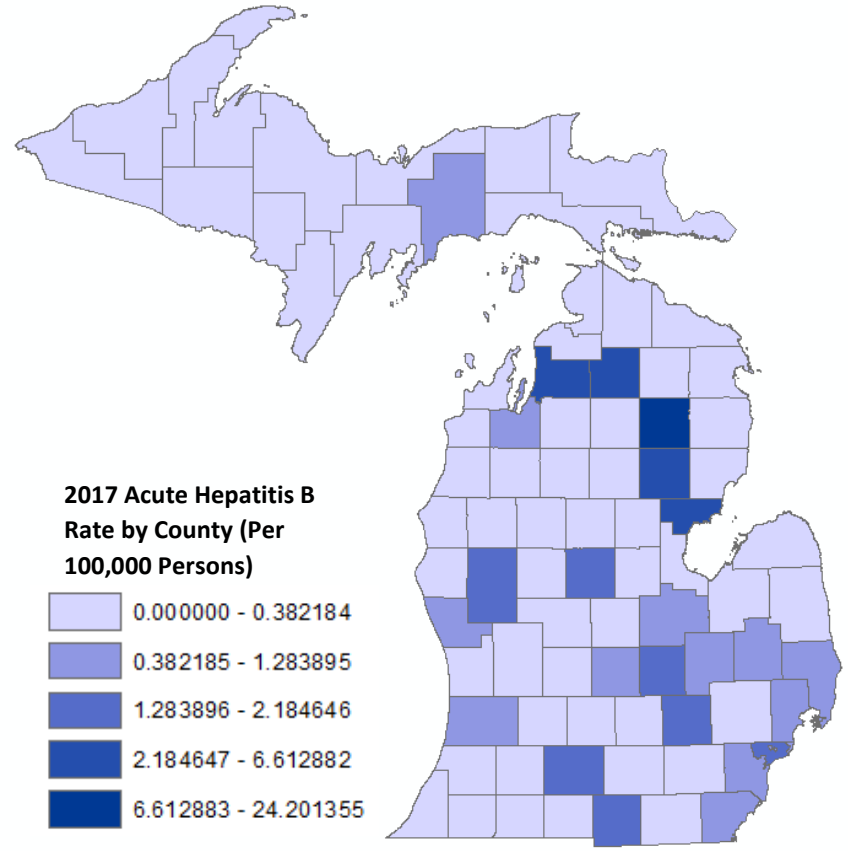
Table 3.4b Response of Completed Acute Hepatitis B Reports* by Risk Behavior in Michigan, 2017

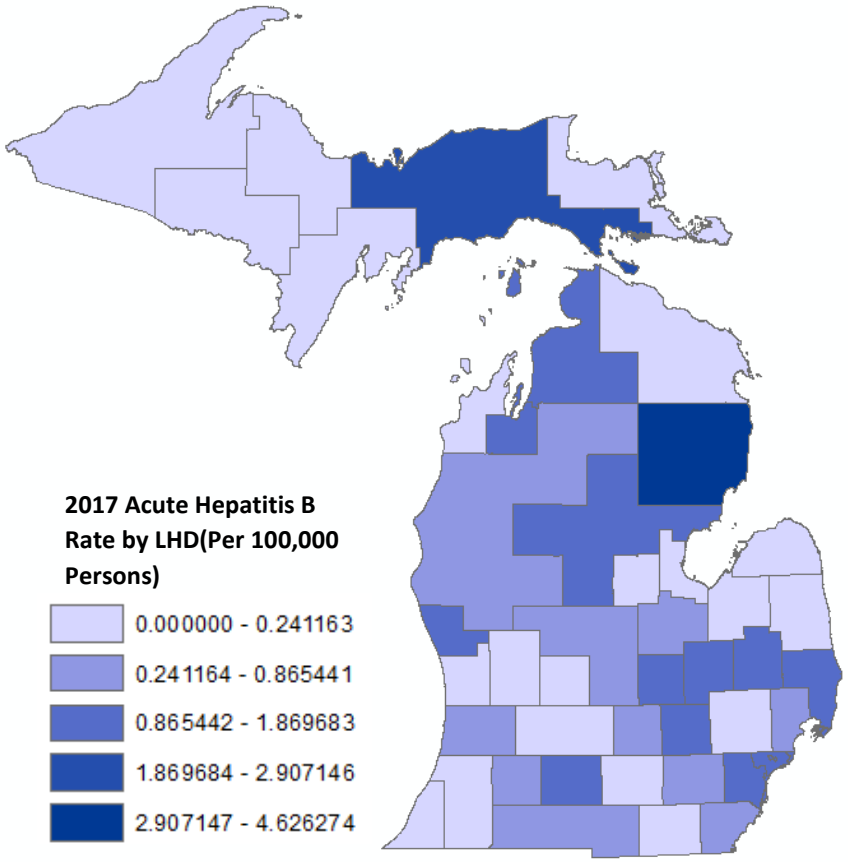
Risk Behavior	Yes*	No*	Unknown*	U.S. - 2014
Injection Drug User	26%	59%	15%	25.80%
Used Street Drugs	37%	49%	14%	
Hemodialysis	2%	81%	18%	0.20%
Received Blood Products	6%	69%	24%	0.10%
Received a Tattoo	21%	47%	32%	
Accidental Needle Stick	2%	68%	31%	4.90%
Contact of Person with Hepatitis B	8%	41%	51%	3.90%
Other Surgery	9%	64%	27%	10.80%
Oral Surgery or Dental Work	18%	53%	29%	
Employed in Medical Field	0%	76%	24%	0.30%
Employed as Public Safety Officer	2%	74%	25%	
Incarceration Longer than 6 Months	13%	53%	34%	
Any Part of Body Pierced (other than ear)	11%	56%	32%	

* Percentages calculated based upon those who completed the field; excludes missing data

Table 3.4b shows the HBV acquisition risk factors reported by clients in the 6 weeks to 6 months prior to onset of symptoms. "Used Street Drugs" was the most common potential exposure, with 'Yes' being selected on 37% of cases with completed risk behavior questions. No 2017 acute HBV cases were employed in a medical field. In general, acute HBV acquisition appears to be most strongly associated with drug use.

Acute Hepatitis B Rate Maps by County and Local Health Jurisdiction





Chronic Hepatitis B

Chronic Hepatitis B—Incidence and Gender

Figure 4.1 Chronic Hepatitis B Cases per 100,000 Persons, Michigan, 2012-2017

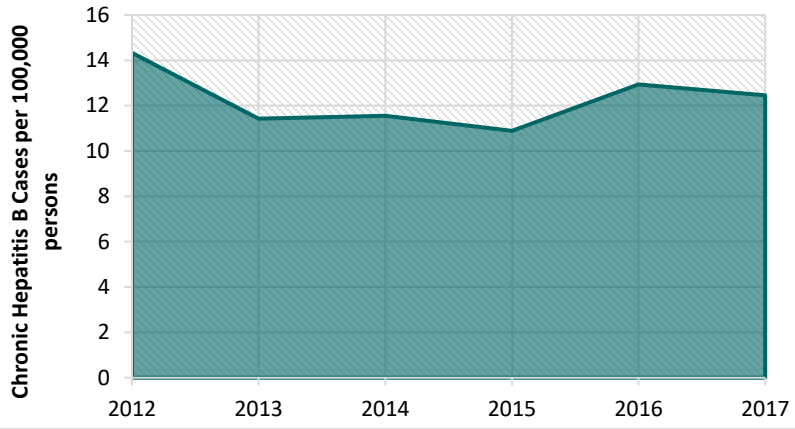


Table 4.1 Chronic Hepatitis B Cases per 100,000 Persons, Michigan, 2012-2017

Year	Michigan Cases	Michigan (Rate per 100,000)
2012	1416	14.33
2013	1130	11.43
2014	1142	11.55
2015	1076	10.89
2016	1283	12.93
2017	1237	12.46

Following decreases in new chronic HBV diagnoses in 2013 and 2015, cases have increased slightly in 2016 and 2017. A map of 2017 chronic HBV rates by count and local health jurisdictions is located on page 29. There is no national benchmark for comparing rates of chronic HBV infection. Decreases in cases after 2012 may be due, in part, to increased de-duplication efforts and removal of redundant cases by MDHHS staff. Increases in the number of cases reported in 2016 may be explained by improved laboratory reporting from some Michigan health systems and/or more frequent ordering of hepatitis panels as a result of the ongoing hepatitis A outbreak.

Figure 4.2 Chronic Hepatitis B Cases per 100,000 Population by Gender, Michigan, 2012-2017

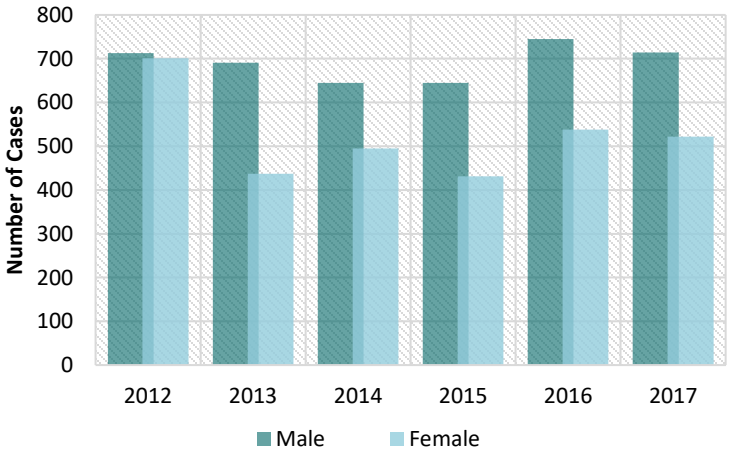


Table 4.2 Chronic Hepatitis B Cases per 100,000 Population by Gender in Michigan, 2012-2017

Year	Male	Male Incidence	Female	Female Incidence
2012	713	14.71	701	13.92
2013	691	14.25	437	8.68
2014	645	13.3	495	9.83
2015	645	13.3	431	8.56
2016	745	15.28	538	10.66
2017	714	14.62	522	10.33

The rate of chronic HBV in males in Michigan has remained higher than the rate in females between the years of 2012 and 2017. The rate for males was lowest in 2014 and 2015, peaked in 2016 and has since decreased in 2017. The rate for females peaked in 2012, then decreased from 2013 through 2015. That decrease is largely due to increased emphasis on the removal of duplicate chronic HBV cases in MDSS, particularly among women of childbearing age. In 2016 the female chronic HBV incidence rate increased to its highest level since 2012, and dropped slightly in 2017.

Chronic Hepatitis B—Race and Ethnicity

Figure 4.3 Chronic Hepatitis B Cases per 100,000 by Race and Ethnicity, Michigan, 2012-2017

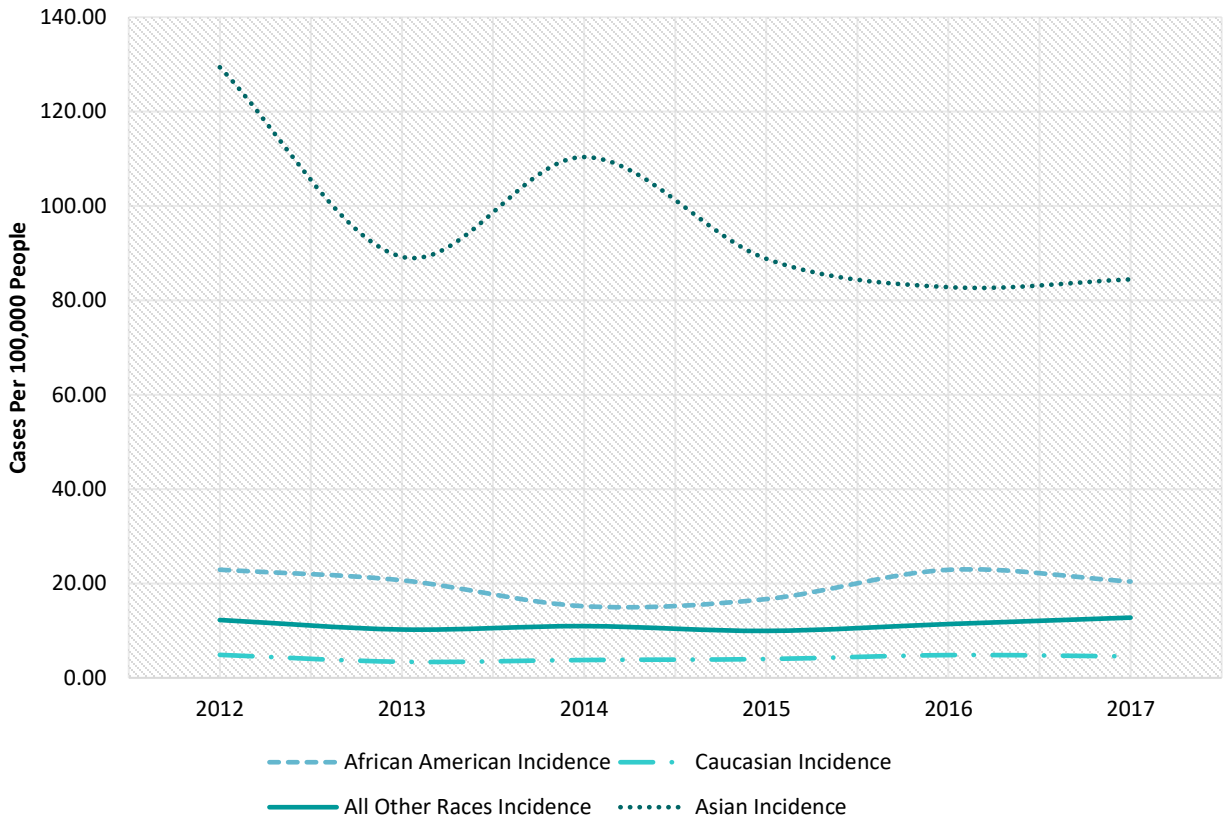
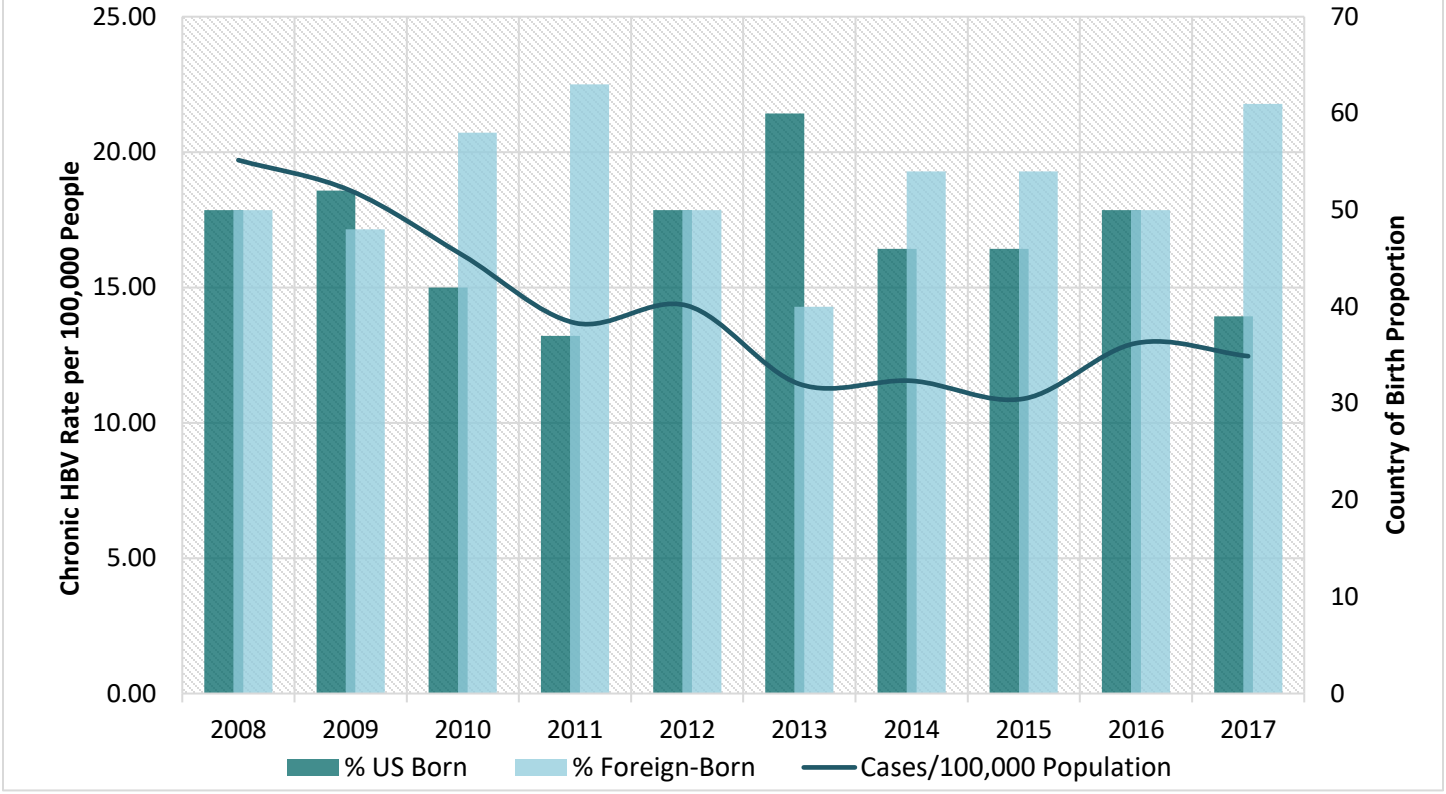


Table 4.3 Chronic Hepatitis B Cases per 100,000 by Race and Ethnicity, Michigan, 2012-2017

Year	African American	African American Incidence	American Indian	American Indian Incidence	Asian	Asian Incidence	Caucasian	Caucasian Incidence	Hispanic	Hispanic Incidence	Other	Other Incidence
2012	500	22.91	1	1.83	306	129.39	369	4.87	8	1.83	76	37.54
2013	286	20.67	5	9.15	211	89.22	257	3.40	14	3.21	52	25.69
2014	210	15.18	6	10.98	261	110.36	286	3.78	18	4.13	52	25.69
2015	231	16.69	8	14.63	210	88.80	302	3.99	13	2.98	48	23.71
2016	312	22.89	2	4.34	242	82.79	361	4.82	24	4.94	63	25.33
2017	275	20.41	2	4.66	246	84.44	340	4.55	18	3.66	84	30.56

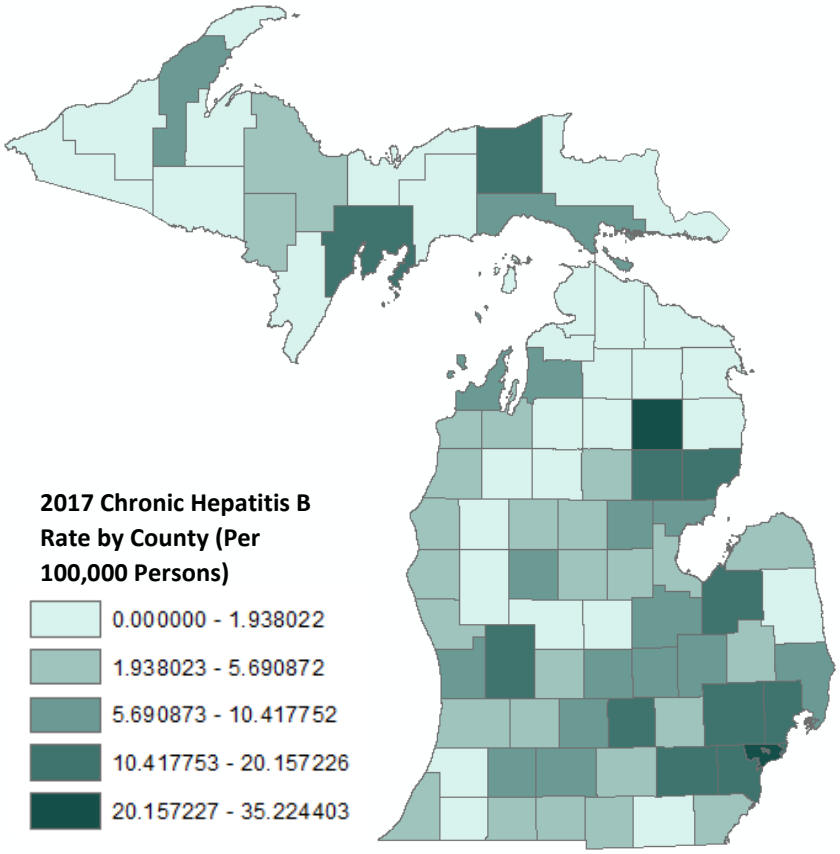
In 2017, Asians had the highest rate (84.44 per 100,000) of chronic HBV infection in Michigan, followed by African Americans (20.41 per 100,000). The Asian infection rate of 84.44 is 18.6 times higher than the 2016 Caucasian rate (4.55 cases per 100,000). Asian-Americans are the target of CDC's KNOW HEPATITIS B campaign due to that disparity.

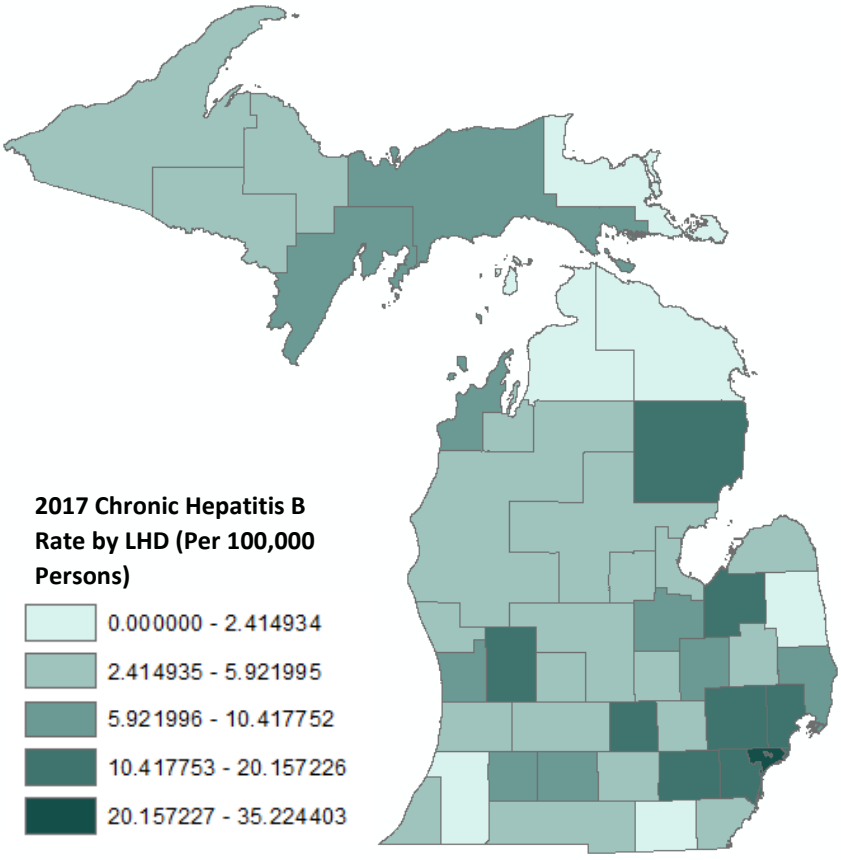
Figure 4.4 Chronic Hepatitis B Cases per 100,000 Population and Country of Birth in Michigan, 2008-2017



Hepatitis B is a vaccine preventable disease. While decreases in HBV have been observed in the US, foreign countries are still greatly impacted by HBV infection. To better understand the Michigan HBV population categorize the proportion of cases that were born in the US versus foreign countries. When comparing the origin of birth among HBV infected individuals in Michigan, more people were born outside the United States than in the United States.

Chronic Hepatitis B Rate Maps by County and Local Health Jurisdiction





Acute Hepatitis C

Acute Hepatitis C—Incidence and Gender

Figure 5.1 Incidence of Acute Hepatitis C, Michigan and U.S., 2012-2017

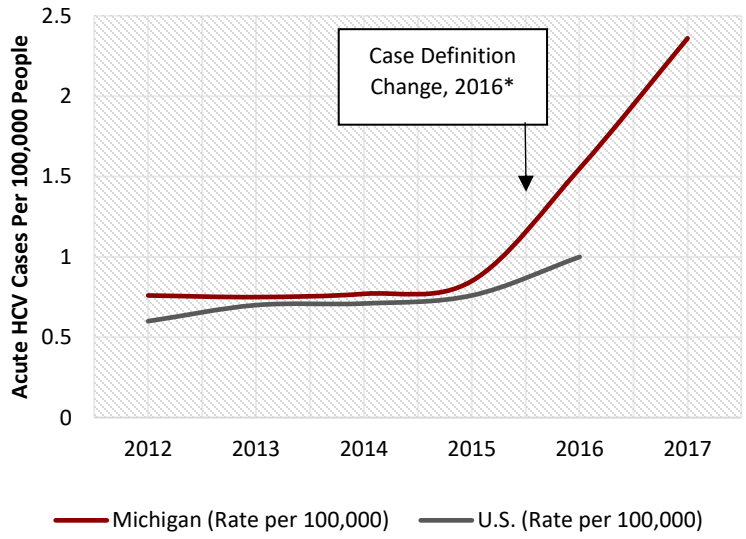


Table 5.1 Incidence of Acute Hepatitis C, Michigan and U.S., 2012-2017

Year	Michigan Cases	Michigan (Rate per 100,000)	U.S. (Rate per 100,000)
2012	75	0.76	0.60
2013	74	0.75	0.70
2014	76	0.77	0.71
2015	84	0.85	0.76
2016	154	1.55	1.00
2017	234	2.36	N/A

The number of acute HCV cases in Michigan remained relatively stable from 2012 to 2014, but increased slightly in 2015 before nearly doubling in 2016 and continuing to increase rapidly in 2017. A CDC/CSTE acute HCV case definition change in January 2016 is at least partially responsible for this sharp increase, along with the concurrent HAV outbreak resulting in an increased ordering of hepatitis panels and, in turn, increased HCV detection. Michigan acute HCV infection rates have closely followed published national benchmarks. There are incidence maps of acute HCV by county and local health jurisdiction for 2017 located on page 34.

Figure 5.2 Incidence of Acute Hepatitis C by Gender, Michigan, 2012-2017

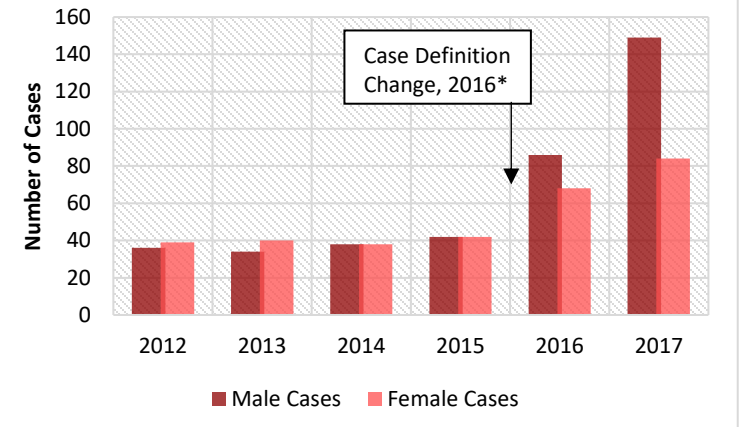


Table 5.2 Incidence of Acute Hepatitis C by Gender in Michigan, 2012-2017

Year	Male Cases	Male Incidence	Female Cases	Female Incidence
2012	36	0.74	39	0.77
2013	34	0.7	40	0.79
2014	38	0.78	38	0.75
2015	42	0.87	42	0.83
2016	86	1.76	68	1.35
2017	149	3.05	84	1.66

Historically, the difference in acute HCV diagnoses between males and females has been minimal, with the exception of 2016 when males totaled 1.3 times more acute HCV diagnoses than females. That divergence continued to grow in 2017 where approximately 64% of new acute HCV infections were men. Again, increases in case counts in 2016-2017 may be related to case counting methodology as a result of the change in case definition, as well as heightened awareness and testing due to the concurrent HAV outbreak in Michigan.

Acute Hepatitis C—Race and Ethnicity

Figure 5.3 Incidence of Acute Hepatitis C by Race and Ethnicity, Michigan, 2012-2017

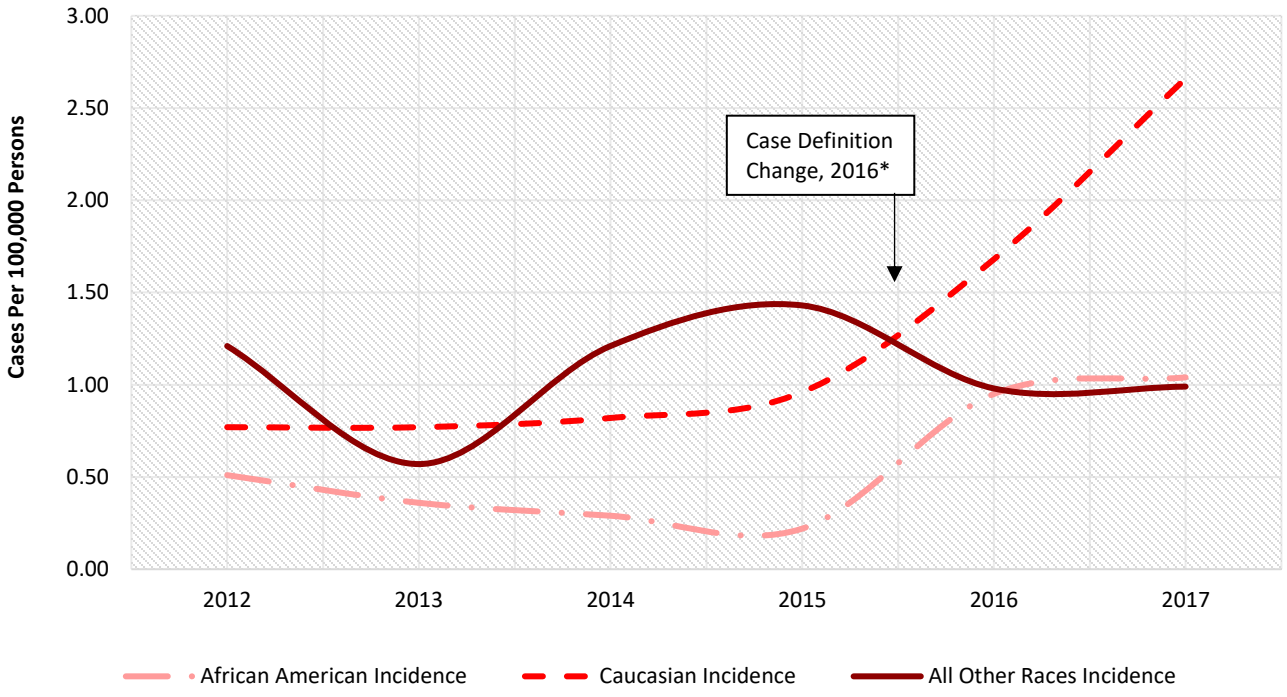


Table 5.3 Incidence of Acute Hepatitis C by Race and Ethnicity, Michigan, 2012-2017

Year	African American	African American Incidence	American Indian or Alaskan Native	American Indian/ Alaskan Native Incidence	Asian	Asian Incidence	Caucasian	Caucasian Incidence	Hispanic	Hispanic Incidence	Other	Other Incidence
2012	7	0.51	2	3.66	0	0.00	58	0.77	3	0.69	1	0.49
2013	5	0.36	1	1.83	0	0.00	58	0.77	2	0.46	0	0.00
2014	4	0.29	2	3.66	0	0.00	62	0.82	3	0.69	1	0.49
2015	3	0.22	2	3.66	1	0.42	73	0.96	5	1.15	1	0.49
2016	13	0.95	1	2.17	1	0.34	126	1.68	1	0.21	3	1.21
2017	14	1.04	1	2.33	1	0.34	199	2.66	8	1.63	1	0.36

Just over 85% of all the acute HCV cases in 2017 were among Caucasians. Caucasians saw an increase from 0.96 cases per 100,000 in 2015 to 1.68 cases per 100,000 in 2016, to 2.66 cases per 100,000 in 2017. Though Native Americans and Alaskan Natives comprise only a few cases of acute HCV each year, the relatively small population of this group in Michigan results in an incidence rate that is disproportionately high at 2.33 cases per 100,000. It should be noted that increases in case counts in these populations may be a result of the 2016 case definition change and hepatitis A outbreak.

Table 5.4a Completeness of Acute Hepatitis C Reports by Risk Behavior, Michigan, 2017 (n= 234)

Risk Behavior	Completed
Injection Drug User	94%
Used Street Drugs	91%
Hemodialysis	91%
Received Blood Products	93%
Received a Tattoo	91%
Accidental Needle Stick	89%
Contact of Person with Hepatitis C	93%
Other Surgery	87%
Oral Surgery or Dental Work	91%
Employed in Medical Field	91%
Employed as Public Safety Officer	92%
Incarceration Longer than 6 Months	90%
Any Part of Body Pierced (other than ear)	91%

Table 5.4a shows the percentage of acute HCV risk behavior questions that were completed by local health department staff in 2017. A risk behavior was considered completed if the question was marked as 'Yes', 'No', or 'Unknown'. Most questions were answered with a response rate of 90% or higher. These results are similar to 2016, and a significant increase from the 83% of case report questions completed in 2015 and a completion percentage of around 75% in 2012 (before viral hepatitis surveillance funding). According to the CDC, the national proportion for completeness of acute HCV case report forms was 60% in 2015.

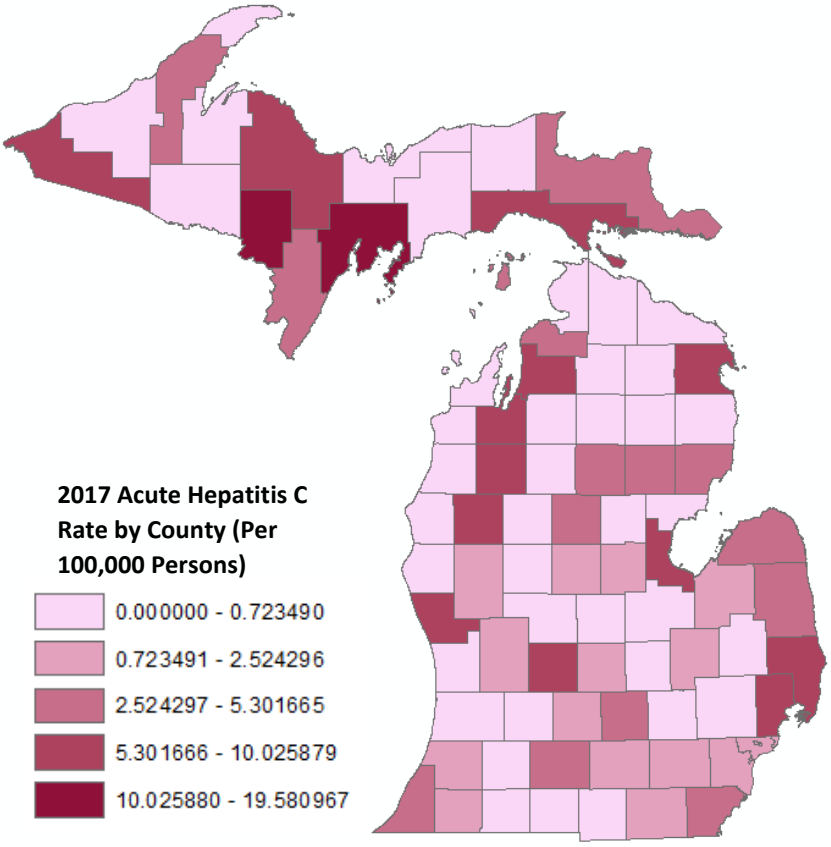
Table 5.4b Response of Completed Acute Hepatitis C Reports* by Risk Behavior, Michigan, 2017

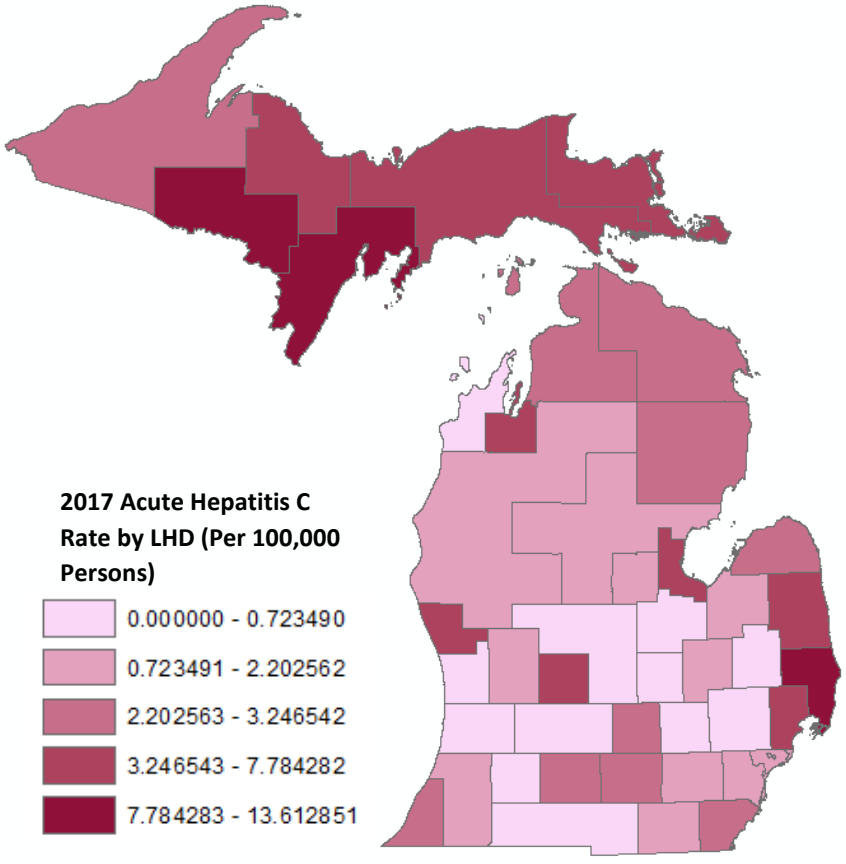
Risk Behavior	Yes*	No*	Unknown*	Yes Responses U.S. Wide 2014
Injection Drug User	65%	24%	11%	68.20%
Used Street Drugs	51%	23%	26%	-
Hemodialysis	1%	64%	36%	0.20%
Received Blood Products	3%	55%	42%	-
Received a Tattoo	21%	24%	55%	-
Accidental Needle Stick	4%	48%	49%	7.70%
Contact of Person with Hepatitis C	19%	25%	56%	-
Other Surgery	10%	36%	54%	12.20%
Oral Surgery or Dental Work	11%	31%	58%	-
Employed in Medical Field	5%	51%	44%	1.00%
Employed as Public Safety Officer	0%	48%	52%	-
Incarceration Longer than 6 Months	13%	33%	54%	-
Any Part of Body Pierced (other than ear)	10%	31%	59%	-

* Percentages calculated based upon those who completed the field; excludes missing data

Table 5.4b shows the responses among the completed questions by risk behavior. Injection drug use stands out as the predominant risk for acquiring HCV infection, as is reported in the literature, and similar to reports from previous years. In fact, injection drug use was more commonly reported in 2017 than it was in 2016 (57%).

Acute Hepatitis C Rate Maps by County and Local Health Jurisdiction





Chronic Hepatitis C

Chronic Hepatitis C—Incidence and Gender

Figure 6.1 Chronic Hepatitis C Cases per 100,000 Persons in Michigan 2012-2017

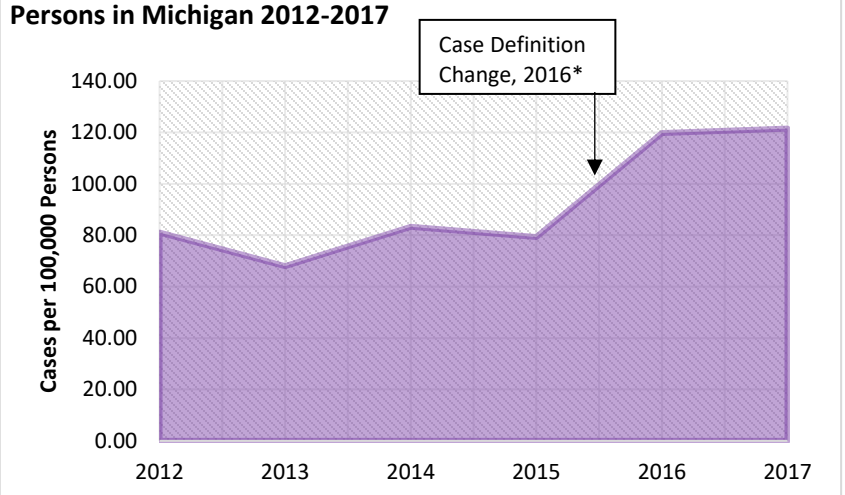


Table 6.1 Chronic Hepatitis C Cases per 100,000 Population in Michigan, 2012-2017

Year	Michigan Cases	Rate per 100,000
2012	8,005	80.99
2013	6,719	67.98
2014	8,233	83.30
2015	7,833	79.25
2016	11,883	119.76
2017	12,062	121.49

In 2017 the rate of incident chronic HCV infections increased 1.4% from 2016. The trend of newly reported chronic HCV infections remained relatively stable through 2015 but underwent a notable 51.1% increase in 2016 before stabilizing again in 2017. A slight decrease in 2013 cases may be due to increased de-duplication efforts and removal of redundant cases by MDHHS Viral Hepatitis Surveillance staff. The 2016 increase may be due to the change in Chronic Hepatitis C case definition. There is no nationally available benchmark for comparing rates of chronic hepatitis.

Figure 6.2 Chronic Hepatitis C Cases per 100,000 Population by Gender in Michigan, 2012-2017

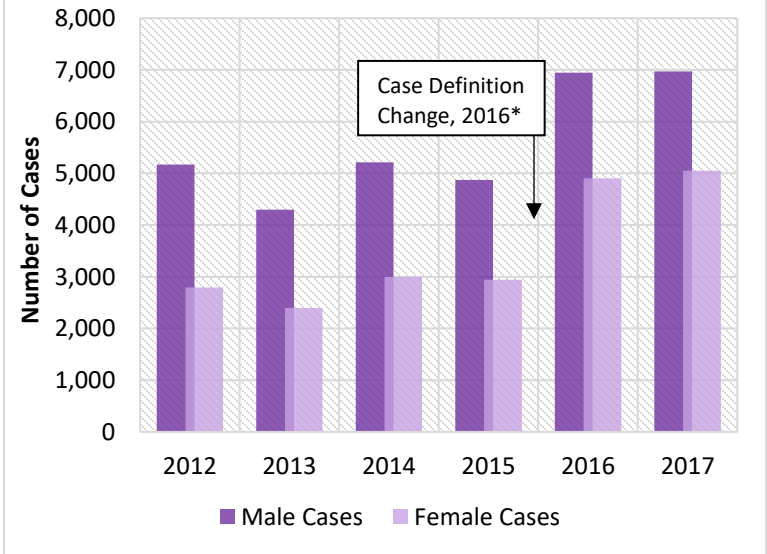


Table 6.2 Chronic Hepatitis C Cases per 100,000 Population by Gender in Michigan 2012-2017

Year	Male Cases	Male Incidence	Female Cases	Female Incidence
2012	5,170	106.64	2,791	55.43
2013	4,299	88.67	2,400	47.66
2014	5,215	107.57	3,000	59.58
2015	4,873	100.51	2,943	58.44
2016	6,946	142.42	4,906	97.23
2017	6,973	142.80	5,054	100.18

Males account for the majority of chronic hepatitis C cases reported each year since 2012. In 2017, the rate of chronic hepatitis C reports was 1.43 times higher in males than females. The marked increase in chronic cases reported in 2016 is likely representative of the change in the national HCV surveillance case definition.

Chronic Hepatitis C—Race and Ethnicity

Figure 6.3 Chronic Hepatitis C Cases per 100,000 by Race and Ethnicity in Michigan, 2012-2017

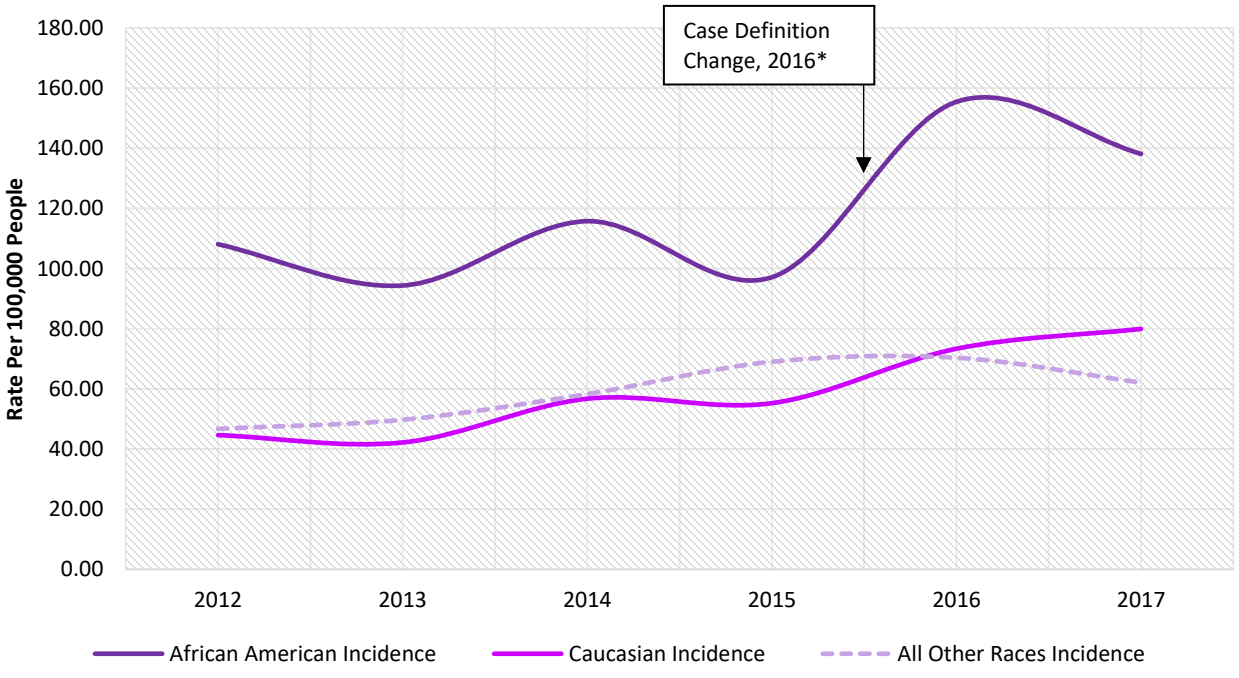


Table 6.3 Chronic Hepatitis C Cases per 100,000 by Race and Ethnicity in Michigan, 2012-2017

Year	African American	African American Incidence	American Indian / Alaskan Native	American Indian / Alaskan Native Incidence	Asian	Asian Incidence	Caucasian	Caucasian Incidence	Hispanic	Hispanic Incidence	Other	Other Incidence
2012	1,496	108.11	58	106.10	35	14.80	3,379	44.64	103	23.60	86	42.48
2013	1,306	94.38	67	122.56	23	9.73	3,194	42.19	97	22.23	90	44.46
2014	1,602	115.77	67	122.56	45	19.03	4,296	56.75	167	38.27	108	53.35
2015	1,344	97.13	86	157.32	44	18.61	4,183	55.26	144	33.00	136	67.18
2016	2,119	155.46	69	149.82	51	17.45	5,492	73.36	213	43.83	175	70.35
2017	1,861	138.15	99	230.67	62	21.28	5,977	79.96	231	47.01	295	105.12

In 2017, American Indian/Alaskan Natives had the highest rate of chronic HCV infection (230.67 per 100,000) and are disproportionately affected compared to other racial groups. Increases in case counts and rates between 2015 and 2016-17 may be the result of the change in the national HCV case definition.

Chronic Hepatitis C—Risk Behaviors

Table 6.4a Completeness of Chronic Hepatitis C Reports by Risk Behavior, Michigan, 2017 (n = 12,062)

Risk Behavior	Completed
Received Blood Transfusion Prior to 1992	57%
Received an Organ Transplant Prior to 1992	56%
Received Clotting Factor Concentrates Prior to 1992	56%
Hemodialysis	56%
Injection Drug User	57%
Incarcerated in Lifetime	57%
Treated for a Sexually Transmitted Disease in Lifetime	55%
Contact of Person with Hepatitis C	56%
Employed in Medical Field	56%

Table 6.4a shows the percentage of chronic hepatitis C risk behavior questions completed by local health department staff in 2017. A risk behavior was considered completed if the question was marked as 'Yes', 'No', or 'Unknown'. Most chronic hepatitis C epidemiologic information questions were completed on 55% of case reports. This proportion has decreased when compared with recent years. In 2012, before viral hepatitis surveillance funding, the chronic HCV risk factor completeness was less than 30%. There is no national comparison for completion of chronic hepatitis C case report forms.

Table 6.4b shows the responses among the completed questions by risk behavior. Injection drug use, incarceration, and being a contact of a person with hepatitis C were the most common risk behaviors associated with chronic hepatitis C.

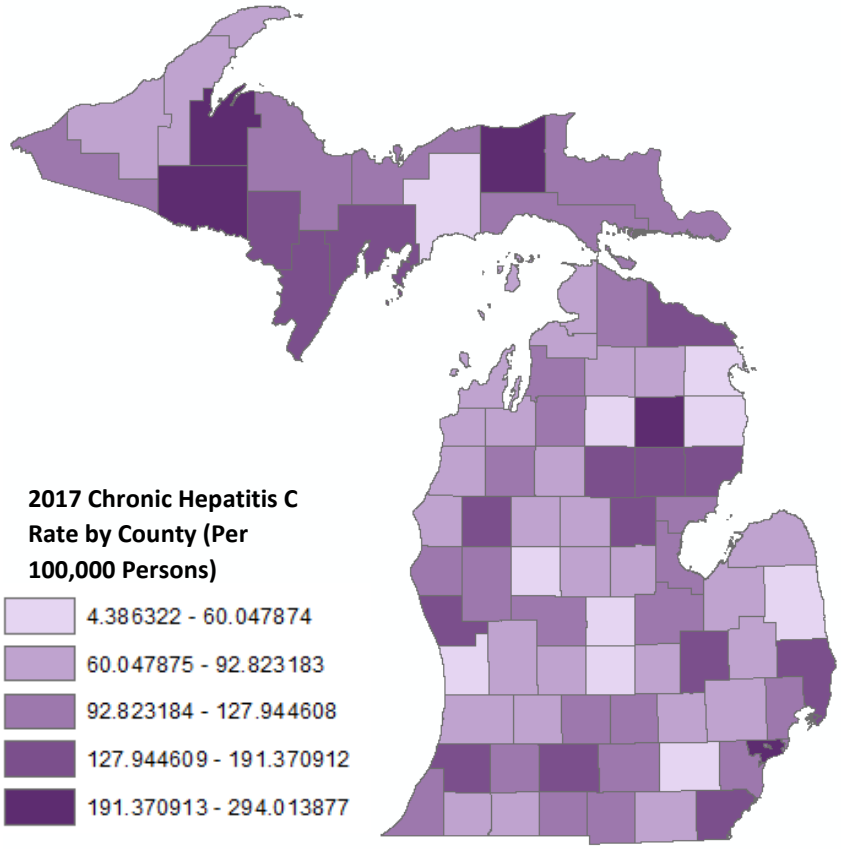
Table 6.4b Response of Completed Chronic Hepatitis C Reports* by Risk Behavior, Michigan, 2017

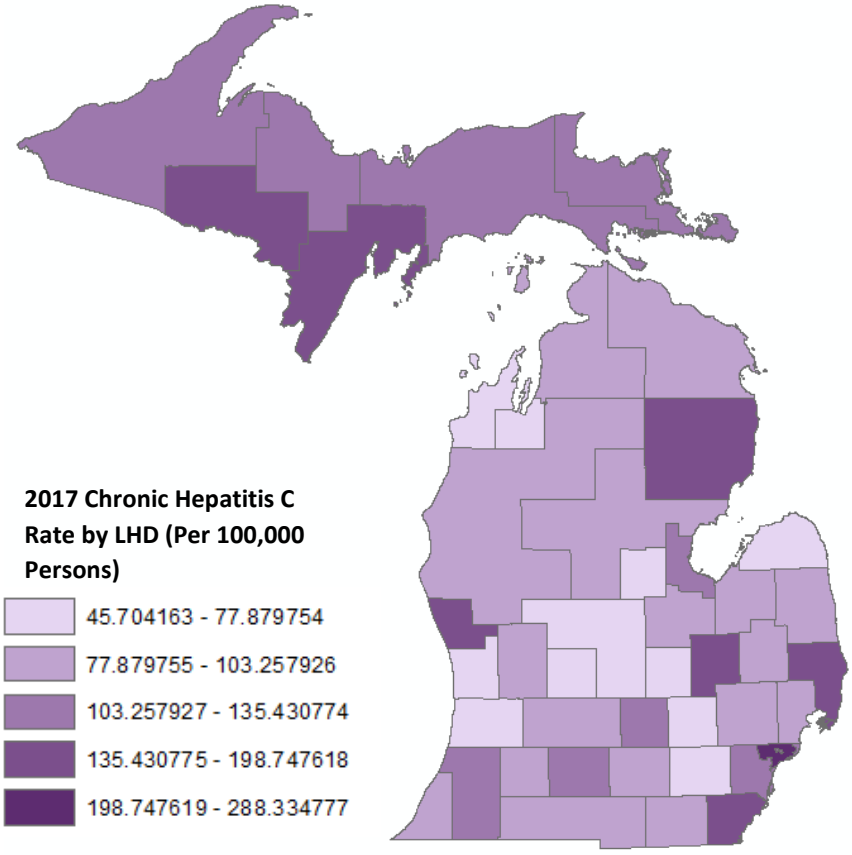
Risk Behavior	Yes*	No*
Received Blood Transfusion Prior to 1992	8%	92%
Received an Organ Transplant Prior to 1992	0%	100%
Received Clotting Factor Concentrates Prior to 1992	1%	99%
Hemodialysis	1%	99%
Injection Drug User	64%	36%
Incarcerated in Lifetime	63%	37%
Treated for a Sexually Transmitted Disease in Lifetime	27%	73%
Contact of Person with Hepatitis C	54%	46%
Employed in Medical Field	10%	90%

* Percentages calculated based upon those who completed the field; excludes missing data

Note: Risk factors and responses are not mutually exclusive

Chronic Hepatitis C Rate Maps by County and Local Health Jurisdiction





Hepatitis C Testing & Treatment

Hepatitis C—Testing and Genotype Data

Figure 7.1 CDC Recommended Testing Algorithm for Hepatitis C Virus Infection

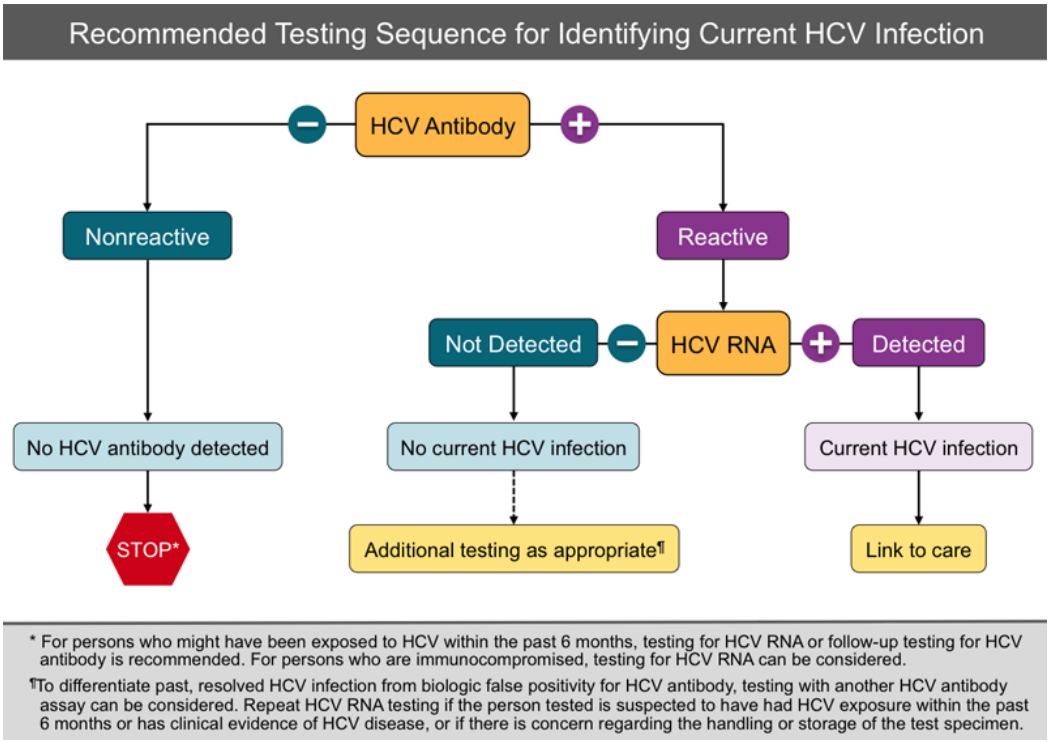
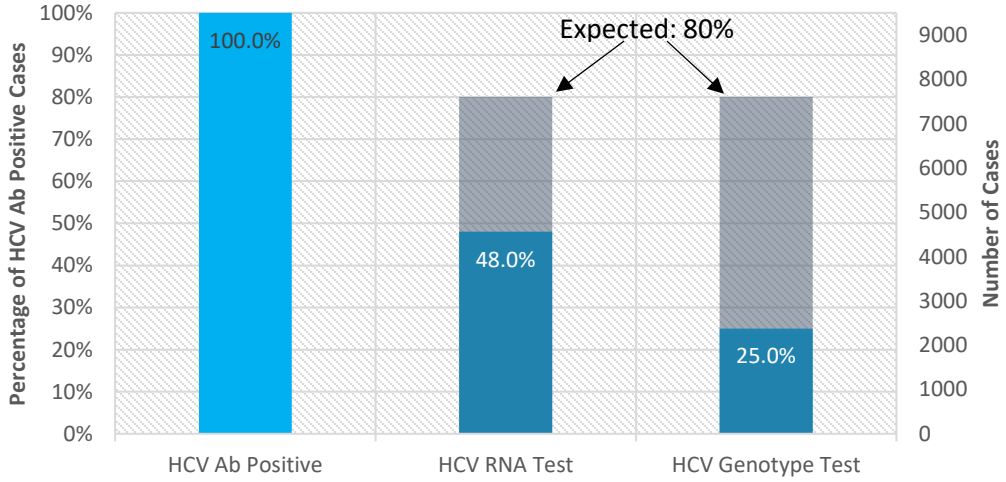


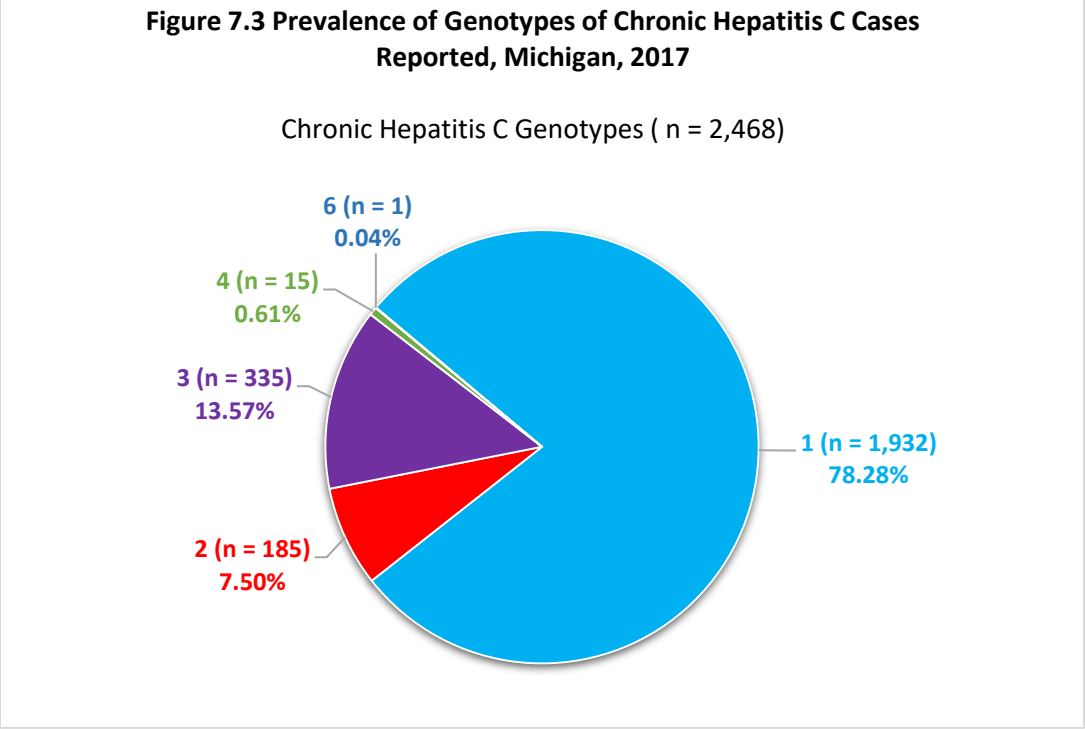
Figure 7.2 Number and Percentage of HCV Antibody Positive Cases with an HCV RNA or HCV Genotype Test, 2017



Of the 12,296 cases of acute and chronic HCV reported in Michigan in 2017, 10,914 (89%) cases were reported with a positive HCV antibody results. Of those cases, 48% were reported with positive HCV RNA test and even fewer (25%) were reported with genotype results. Negative HCV RNA tests are not reportable in Michigan. Since 20-25% of persons exposed to HCV clear infection, we would expect 75-80% of those with a positive HCV antibody to have a positive HCV RNA test, if the testing algorithm is being followed by all providers. These data suggest a gap in getting HCV antibody positive patients confirmatory testing and genotype testing which indicates engagement in follow-up for treatment.

All patients with a positive HCV RNA test should have a genotype test performed to help direct HCV treatment as some regimens are indicated for certain genotypes. Of the patients reported to MDSS with a positive HCV antibody, there was evidence of only 25% receiving an HCV genotype test, suggesting that many patients are not yet being evaluated for HCV therapy.

Figure 7.3 Prevalence of Genotypes of Chronic Hepatitis C Cases Reported, Michigan, 2017



A total of 2,468 chronic HCV patients had a genotype result reported to MDHHS in 2017. Of these, 78.28% were reported with genotype 1 infection (79.61% were subtype 1a and 16.93% were subtype 1b). Genotypes 3 and 2 made up the majority of non-genotype 1 specimens. The remaining specimens were either genotype 4 or 6, which made up less than 1% of all genotyped specimens in 2017.

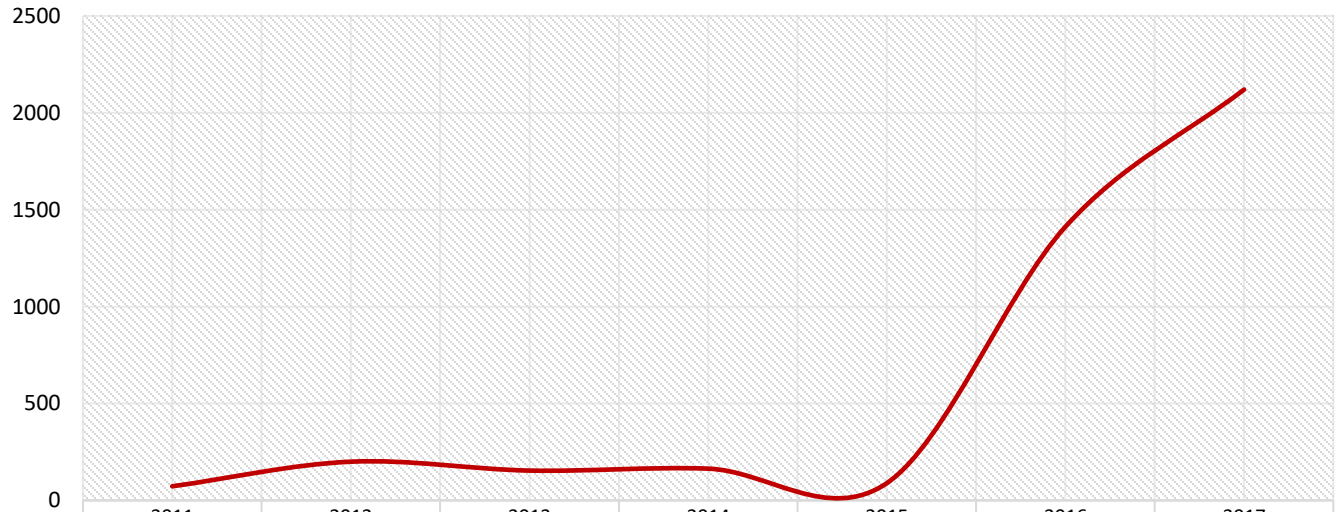
This pattern of genotypes is consistent with the expected annual proportions in Michigan. The data is also consistent with the national distribution, as the predominant genotypes nationwide are 1a, 1b, 2a, 2b, and 3a.

Viral Hepatitis Medicaid Data

There has been an explosion of new drugs approved to treat HCV over the last few years. In many instances, these direct acting antivirals can effectively cure a patient of their HCV infection, greatly reducing the risk of cirrhosis, hepatocellular carcinoma, and death. However, as previously described patients often need to go through a cascade of testing in order to have a HCV medication prescribed.

Figure 7.4 looks at the number of Michigan Medicaid patients prescribed various HCV treatments from 2011 to 2017. Older drugs, like Incivek and Victrelis, are no longer prescribed as superior products are now available (e.g. Harvoni, Mavyret). Recent data shows the Michigan Medicaid/CHIP covers approximately 2.3 million persons. With an estimated 1-2% HCV infection rate in the population, there would be 23,000-46,000 Medicaid insured persons with HCV infection. According to these data, with 4,143 unique persons treated for HCV, approximately 8-12% of the HCV-infected Medicaid population has been prescribed an HCV direct-acting antiviral. Again, the data suggest that increased efforts to test and treat HCV infection are needed to help reduce risk of future morbidity and mortality associated with chronic HCV infection. It is encouraging to see more patients being prescribed HCV medications and this trend is likely to continue as Medicaid reduces restrictions on HCV prior authorizations.

Figure 7.4 Total Number of Medicaid Members with Prescriptions, by Medication, 2011-2017



	2011	2012	2013	2014	2015	2016	2017
Victrelis	20	117	104	23			
Incivek	53	83	48	2			
Sovaldi			2	125	24	111	4
Harvoni				5	60	1019	1418
Olysio				9	1	1	
Daklinza					2	84	4
Viekira Pak					2	13	12
Epclusa						151	417
Technivie						2	4
Zepatier						31	170
Mavyret							64
Vosevi							27
TOTAL	73	200	154	164	89	1412	2120

Bureau of Labs (BOL) Hepatitis C Testing

The MDHHS Bureau of Laboratories (BOL) has historically performed testing for HCV antibody. In 2014, the virology lab began performing HCV RNA testing for all specimens testing positive for HCV antibody in recognition of CDC's HCV testing algorithm. The data below look at the number of tests conducted by the BOL, positivity rates, and the demographic characteristics of patients tested.

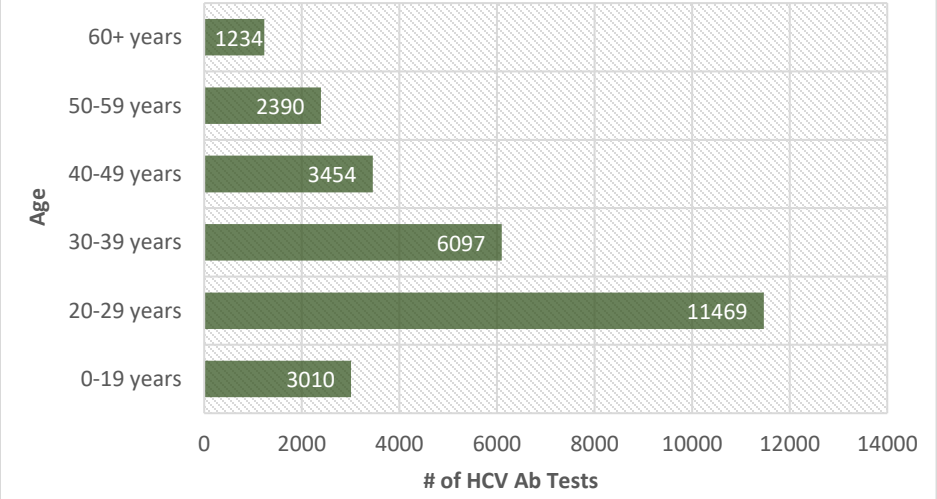
Some samples were deemed "unsatisfactory" because of poor shipping, packaging, or labeling and therefore not tested.

Table 7.1 BOL HCV Antibody Tests, 2012-2017

Year	# of Samples Tested	# of Unsatisfactory or Not Tested	# Negative	# Positive	% Positive
2012	3764	6	3575	188	5.00%
2013	3798	7	3596	202	5.32%
2014	3321	26	2935	286	8.88%
2015	3351	25	3156	195	5.82%
2016	6252	33	5975	277	4.43%
2017	7130	46	6849	281	3.94%

The number of HCV antibody tests conducted by the MDHHS BOL has remained relatively steady from 2012-2015, with slight decreases in 2014 and 2015. In 2016 there were approximately twice as many HCV screening tests performed compared to previous years. Testing continued to increase in 2017, as MDHHS is continually engaged in efforts to increase HCV testing through BOL. HCV Ab positivity rates have continued to hover around 4-5%.

Figure 7.5 All HCV Antibody Tests by Age, 2012-2017



Of the 27-654 HCV Ab tests ran from 2012-2017, the majority of individuals tested were between 20-29 years old. The smallest proportion of tests were found amongst those 60 years of age and older, making up only 4% of all individuals tested for HCV Ab.

Table 7.2 BOL HCV PCR Testing, 2014-2017

Year	# of Samples Tested	# of Unsatisfactory or Not Tested	# Negative	# Positive	% Positive
2014	245	41	79	166	67.76%
2015	168	27	65	103	61.31%
2016	378	15	222	154	40.96%
2017	270	13	127	143	52.96%

Figure 7.6 BOL HCV PCR Testing by Year, 2014-2017

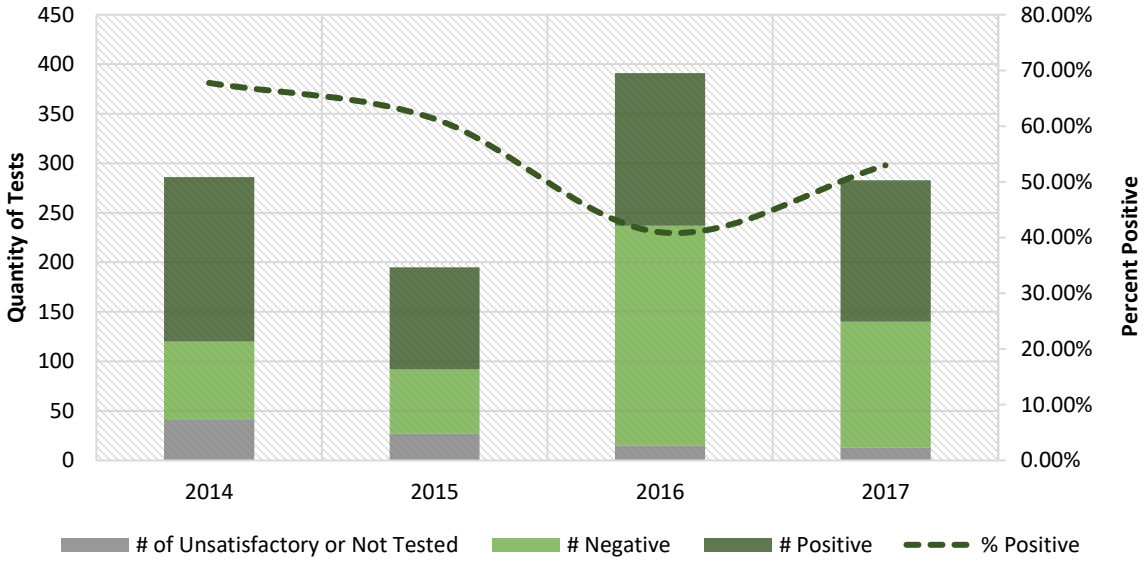
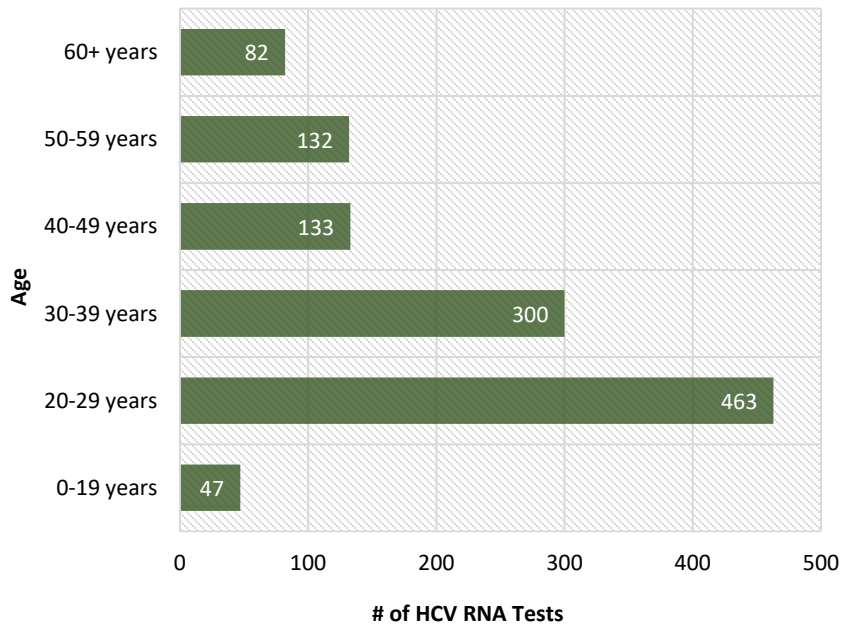


Figure 7.7 All HCV RNA Tests Stratified by Age, 2014-2017



The number of PCR tests conducted by the BOL decreased in 2015, but then doubled in 2016 before decreasing again in 2017 to a total of 283 tests analyzed. The percentage of tests that yielded positive results decreased from 61.3% in 2015 to 53.0% in 2017.

The number of HCV RNA tests and the positivity rate in 2016 is likely the result of an increase in specimen submission from lower risk groups.

Of the 1,157 HCV RNA tests ran by BOL from 2014-2017, 40.0% of individuals were 20-29 years old. The smallest proportion of tests were found amongst those 0-19 years old (4.1%) and those 60 years of age and older (7.1%).

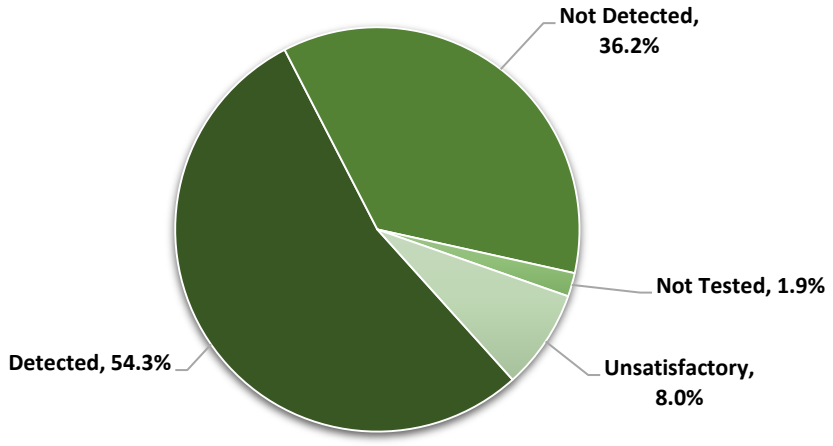
Table 7.3 BOL Patient Demographics for Patients Testing HCV Antibody/RNA Positive 2014-2017

Variable	n	%
N	1,031	
Sex		
Male	598	58.0%
Female	419	40.6%
Unknown	14	1.4%
Race		
American Indian/Alaskan Native	4	0.4%
Asian	4	0.4%
Black or African American	150	14.5%
Native Hawaiian/ Pacific Islander	1	0.1%
White or Caucasian	772	74.9%
Multiracial	6	0.6%
Other	13	1.3%
Unknown	81	7.9%
Age		
0-19	36	3.5%
20-29	410	39.8%
30-39	268	26.0%
40-49	122	11.8%
50-59	119	11.5%
60+	76	7.4%

There were 1,031 patients who tested positive for HCV antibody and/or RNA at BOL between 2014-2017. Just over half (58.0%) of individuals who tested positive were male. The majority (74.9%) of those who were positive were Caucasian, which was much higher than African Americans who only comprised 14.5% of positive test results. In addition, 39.8% of individuals who tested positive were 20-29 years old. This is much higher than the baby boomer population, which only accounted for about 11.5% of positive test results.

Many of our specimen submitters are local health department health clinics. These data may be indicative of the patient population who often utilizes local health departments for health services.

Figure 7.8 PCR Test Results following a Positive HCV Antibody Test 2014-2017



Of the 1,031 positive HCV screen tests, just over half (54.3%) had a positive PCR test result. About one-third of positive HCV screen tests were negative by PCR (36.2%).

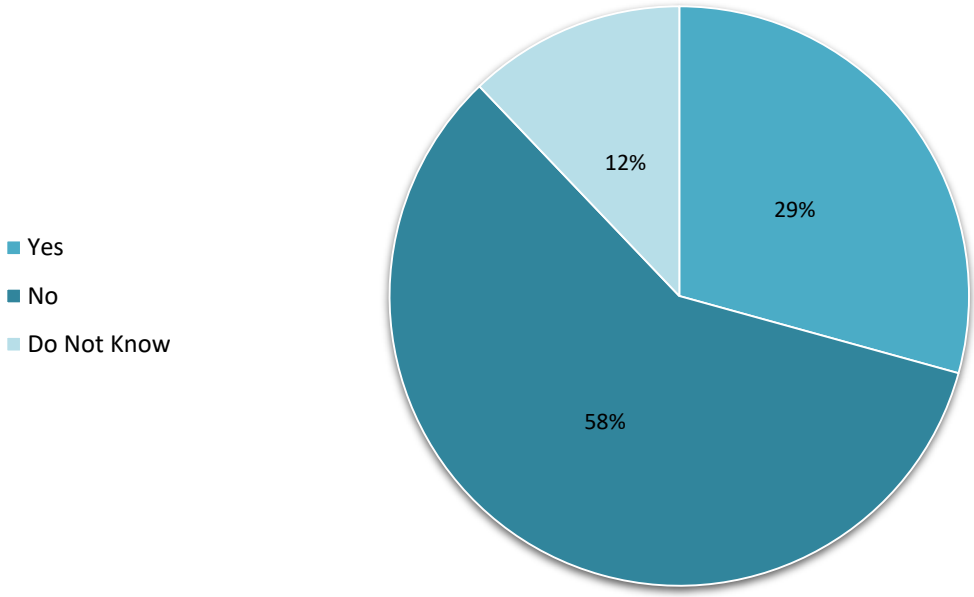
Specimens are required to be shipped cold to be tested for HCV RNA. Any specimen not shipped cold would have unsatisfactory for HCV RNA testing.

Hepatitis C—MI Behavioral Risk Factor Survey Data

The Michigan Behavioral Risk Factor Surveillance System (MiBRFSS) is composed of annual, state-level telephone surveys of Michigan residents, aged 18 years and older. These annual state-level surveys also known as Michigan Behavioral Risk Factor Surveys (MiBRFS) act as the only source of state-specific, population-based estimates of the prevalence of various behaviors, medical conditions, and preventive health care practices among Michigan adults. The MDHHS Viral Hepatitis Unit added the question "Have you ever been tested for Hepatitis C Virus?" to the 2016 MIBRFS to determine demographic and behavioral factors associated with HCV testing. Data collected from the MiBRFS in 2016 (N=3,648) was stratified based on HCV testing status and analyzed by various socio-demographic and behavioral factors.

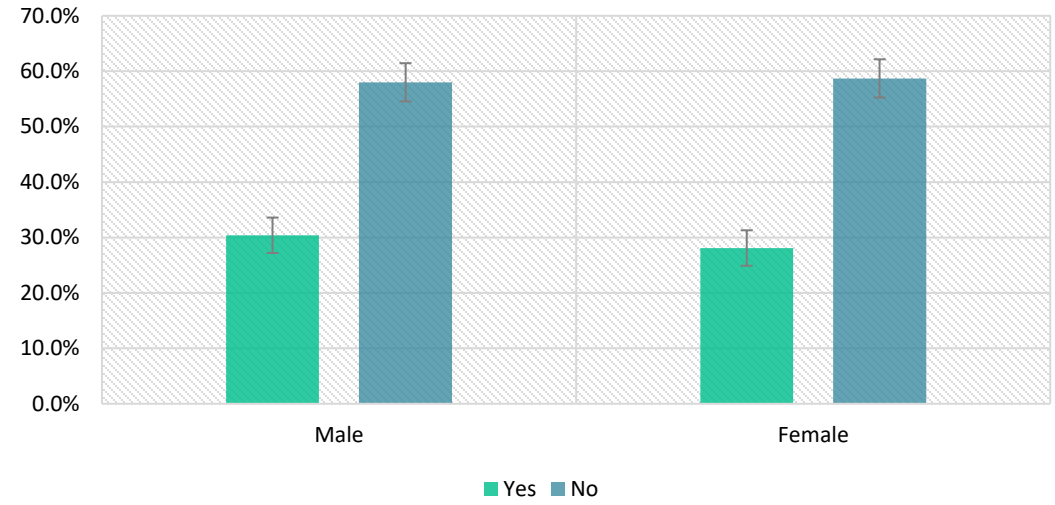
We hope to monitor trends in these data over time to determine if HCV testing is increasing. In addition, the information provided will help us develop targeted strategies to increase HCV testing.

Figure 8.1 MiBRFS "Have You Ever Been Tested for HCV?", 2016 (n=3,648)



A total of 2,689 participants responded to the question "Have you ever been tested for HCV" in the 2016 MiBRFS. Of these participants, 1,037 (29%) reported ever being tested for HCV while over half (58%, 2,159 participants) of respondents had never been tested for HCV. Not everyone is recommended to be tested for HCV. HCV testing is recommended for persons with a known HCV risk factor and those born between 1945 and 1965. When compared to the 2015 iteration of this survey, these results are nearly identical, only differing by a 1% decrease in the "Do Not Know" category.

Figure 8.2 MiBRFS "Ever tested for HCV?" by Sex, 2016



Ever being tested for HCV did not vary significantly between males and females who responded to the survey.

Table 8.1 MiBRFS "Ever tested for HCV?" by Race, 2016

Race	Yes	No
Caucasian	27.20% (25.0-29.5)	59.90% (57.5-62.3)
African American	39.90% (33.1-47.2)	50.40% (43.1-57.7)
Other/Multi-racial	44.60% (31.8-58.3)	44.30% (31.1-58.5)
Hispanic	25.80% (17.1-37.1)	65.10% (53.2-75.4)

Caucasians were less likely to have reported being tested for HCV (26.4%) compared to other racial groups. Hispanics were the most likely to have reported being tested (52.1%) compared to Caucasians and African Americans.

Table 8.2 MiBRFS "Ever tested for HCV?" by Age, 2016

Age	Yes	No
18-49 years	32.40% (29.2-35.9)	54.10% (50.4-57.6)
50-70 years	30.60% (27.7-33.6)	59.20% (56.0-62.2)
71+ years	12.90% (10.3-16.1)	73.50% (69.3-77.3)

"Baby Boomers", persons approximately 50 to 70 years old at the time of the survey, were less likely to have reported ever being tested for HCV than those less than 50 years old (30.6% compared to 32.4%). Those over 70 years old were the least likely to report ever being tested for HCV (12.9%).

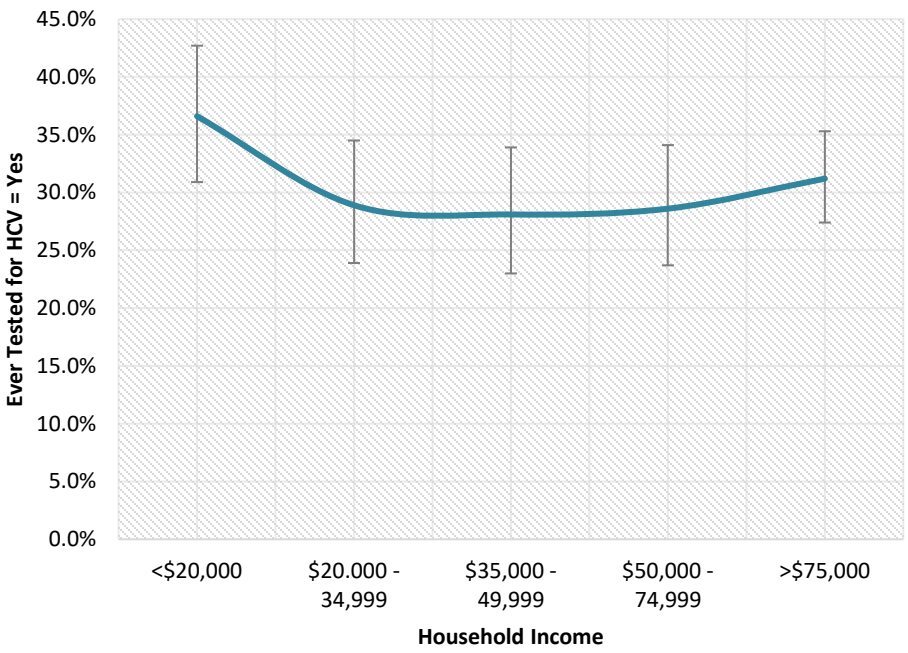
Future HCV screening campaigns may want to focus on the Baby Boomer birth cohort screening recommendation.

Table 8.3 MiBRFS "Ever tested for HCV?" by Insurance Type, 2016

	Private	Medicaid	Medicare	Healthy Michigan	Medicaid + Medicare	None
Yes	30.20% (27.4-33.1)	37.00% (29.1-45.7)	21.90% (18.6-25.5)	39.40% (27.2-53.0)	43.40% (33.0-54.4)	23.80% (17.3-31.9)
No	56.50% (53.4-59.6)	52.60% (44.0-61.1)	66.50% (62.6-70.2)	49.20% (36.2-62.3)	49.70% (39.3-60.1)	61.30% (51.9-69.9)

Not having insurance or having public insurance is often seen as a barrier to receiving HCV testing. However, according to the BRFSS survey, persons with Medicaid were more likely to be tested for HCV than those with private insurance. Of the public insurance options, members of both Medicare and Medicaid were the most likely to have ever been tested for HCV (43.4%). The proportion of persons with private health insurance that were tested for HCV (30.2%) was lower than public insurance, but higher than the uninsured population (23.8%). When compared to survey results from 2015 the Medicaid population that was tested for HCV decreased by nearly 23% while the other categories remained stable.

Figure 8.3 MiBRFS Ever tested for HCV? by Household Income, 2016

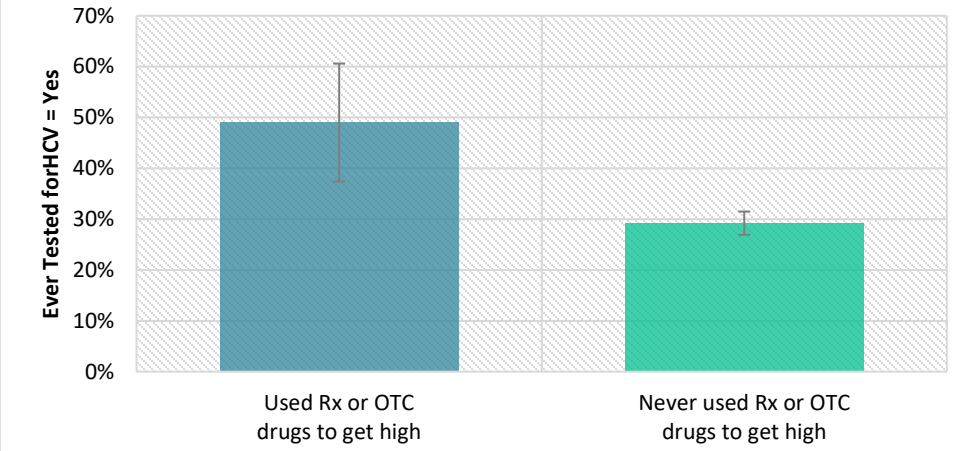


It is thought that those with lower income experience significant barriers to receiving diagnostic testing services.

However, according to the survey data, there was an inverse correlation between household income and likelihood of ever being tested for HCV. As household income increased, respondents became less likely to have been tested for HCV.

This might suggest that persons with higher income are less likely to have risk factors for HCV exposure compared to those with lower income and therefore are not indicated for HCV testing. But it also indicates that low income may not be a major barrier to HCV testing as the perception would suggest.

Figure 8.4 MiBRFS Ever been tested for HCV? by use of Prescription (Rx) or Over-the-counter (OTC) Drugs to get High, 2015



We have previously discussed the relationship between prescription opioid abuse, heroin use, and the risk of bloodborne pathogen transmission when sharing injection drug use equipment. These data show that those who reported ever "abusing" Rx or OTC drugs were more likely to have ever been tested for HCV (49% vs. 29%). Note that this data was not reported in the 2016 MiBRFSS

Figure 8.5 MiBRFS Ever tested for HCV? by History of being tested for HIV, 2016

HIV and HCV share modes of transmission and many patients have risk factors for both HIV and HCV.

These data show that individuals who had an HIV test were more likely to have ever been tested for HCV than those who never had an HIV test. Of the persons surveyed who had an HIV test, 53% reported also being tested for HCV while only 19% of those that never had an HIV test had ever been tested for HCV.

The information suggests that co-location of HIV and HCV testing services may help increase HCV screening.

Special Populations

Young Adults (18-29 years of age)

Figure 9.1 Number of Chronic Hepatitis C Cases Reported to MDHHS by Year of Birth, 2017

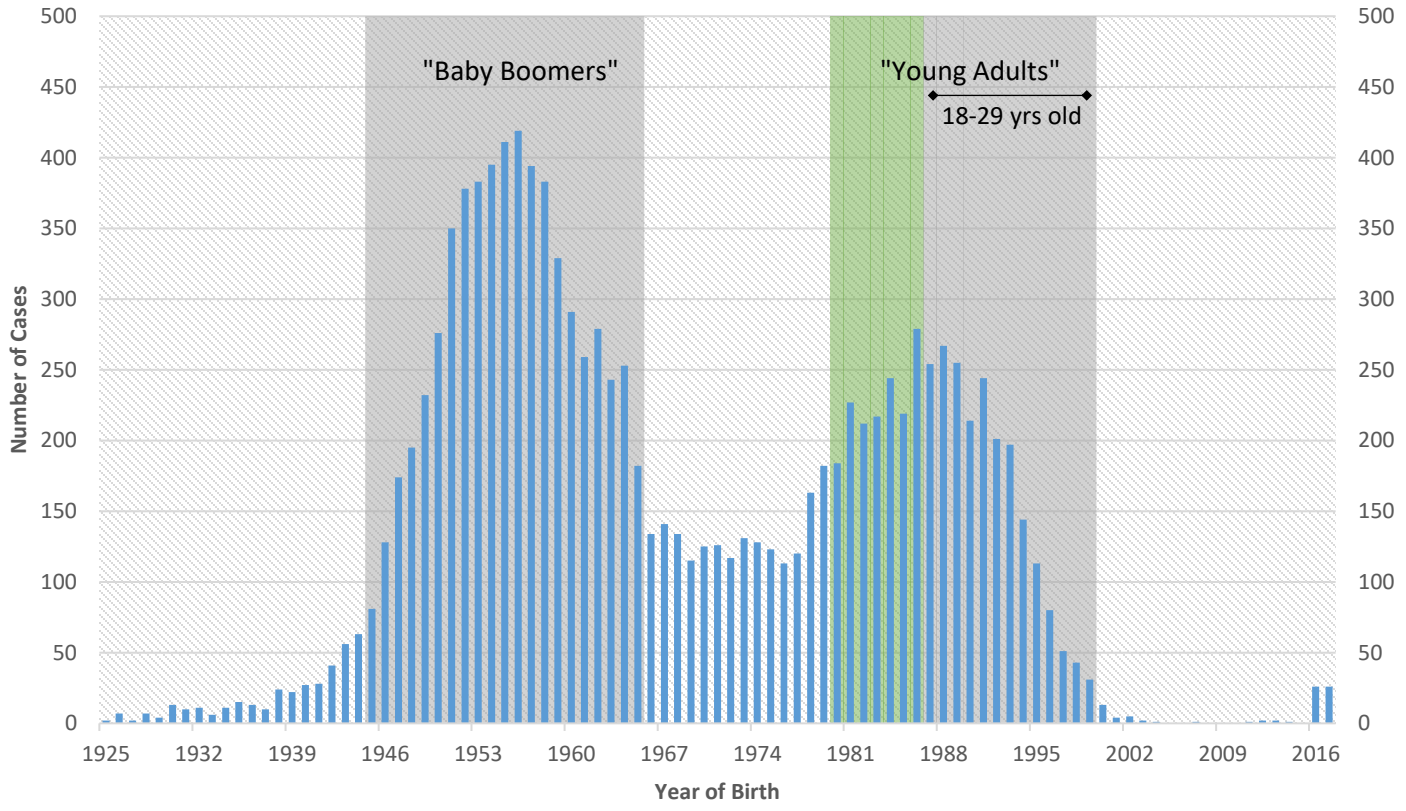


Figure 9.1 depicts the number of chronic HCV cases reported to MDHHS by birth year in 2017. “Baby Boomers”, those born between 1945 and 1965, are five times more likely than other adults to be infected with HCV according to national statistics. CDC now recommends one-time HCV testing of everyone born between 1945 and 1965. MDHHS data shows that the number of new chronic HCV diagnoses in persons born between 1945 and 1965 is the largest of any other birth cohort.

However, in recent years a second ‘peak’ of new chronic HCV diagnoses has developed in young adults aged approximately 18-29. Note that as this cohort ages, the beginning of the peak is now over 30 years old (green shading in figure 9.1). An emerging epidemic of HCV in young adults has been identified in areas across the US and in Michigan. The primary driver of this increase in HCV cases is sharing of injection drug equipment and works related to the concurrent opiate and heroin epidemics. For more information please see the next section.

Figure 9.2 Number of Chronic Hepatitis C Cases Reported to MDHHS by year, 18-29 years of age, 2000-2017

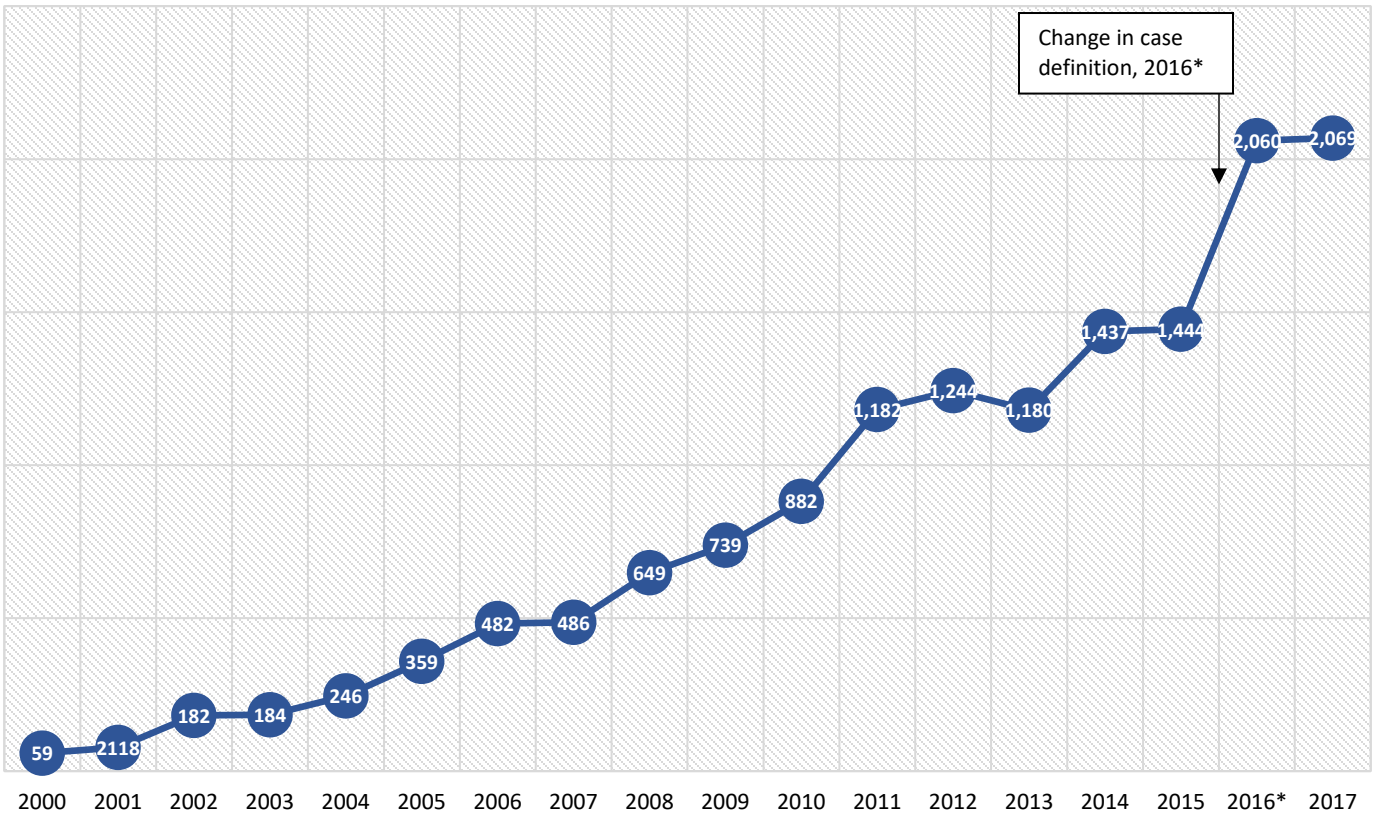


Table 9.1 Number and Percentage of Chronic Hepatitis C cases reported to MDHHS aged 18-29, 2000-2017

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	2017
Total Cases	1,498	2,486	4,296	4,638	5,169	7,347	8,117	6,998	8,464	7,732	7,214	8,006	7,967	6,703	8,233	7,833	11,883	12,062
Number of Cases 18-29 Years Old	59	78	182	184	246	359	482	486	649	739	882	1,182	1,244	1,180	1,437	1,444	2,060	2,069
Percentage of Total Cases	4%	3%	4%	4%	5%	5%	6%	7%	8%	10%	12%	15%	16%	18%	17%	18%	17%	17%

Since 2000 the number of new HCV diagnoses among persons 18 to 29 years of age have increased every year, with the exception of 2013 (Figure 9.2). More specifically, the number of cases has increased 200% per year between 2000 and 2017. The dramatic rise in new HCV diagnoses in this population in 2016 and 2017 can be largely explained by the change in case definition. Table 9.1 shows that the proportion of all reported cases that were between the ages of 18 and 29 has stayed relatively stable (17-18%) despite the increase in the number of case reports.

Table 9.2 Epidemiologic Summary of 2017 Chronic HCV Cases Aged 18-29 Years Old

Age (n = 2,069)		
Median	26	
Mean	25.14	
Range	18 - 29	
Sex (n = 2,062)		**Rate per 100,000**
Female	991 (48.1%)	124.32
Male	1,071 (51.9%)	128.26
Race (n = 1,607)		**Rate per 100,000**
White	1,412 (87.9%)	117.08
Black	149 (9.3%)	56.80
American Indian	36 (2.2%)	430.78
Asian	10 (0.6%)	15.23
Hispanic Ethnicity (n = 1,268)		**Rate per 100,000**
Hispanic or Latino	50 (3.9%)	49.62
Not Hispanic or Latino	1,218 (96.1%)	79.74
Arab Ethnicity (n = 784)		**Rate per 100,000**
Arab Ethnicity	1 (0.1%)	Not Available
Non-Arab	783 (99.9%)	Not Available
History of IVDU (n = 954)		
Yes	811 (85.0%)	
No	143 (15.0%)	

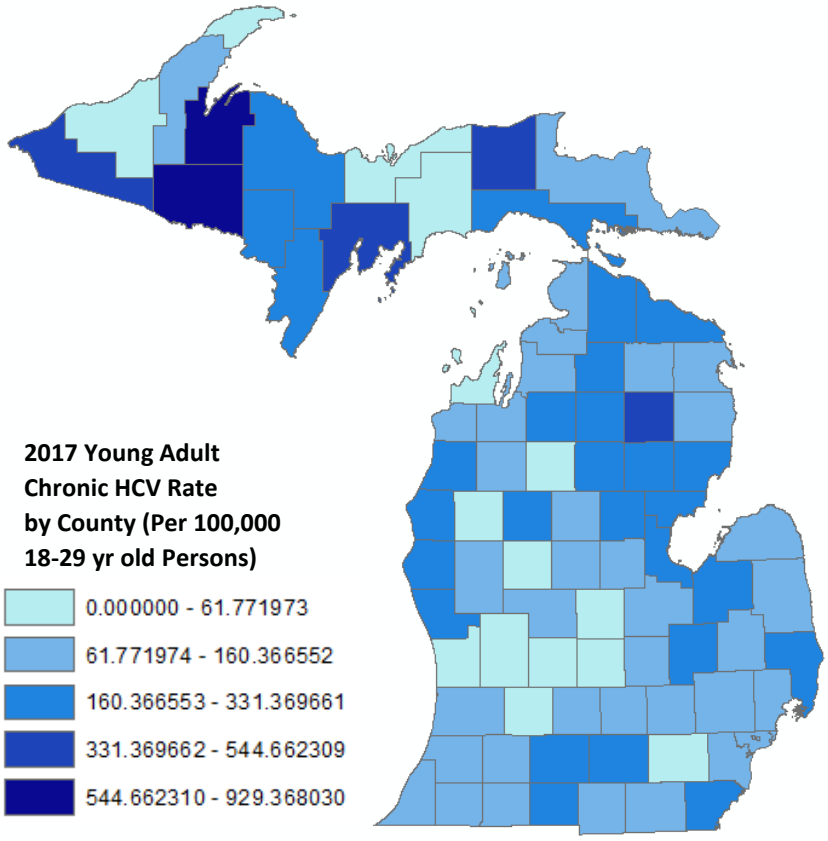
Previous studies conducted by MDHHS have shown injection drug use as the primary risk factor for HCV acquisition among those aged 18-29 years old. In many instances these clients reported sharing needles, syringes, and other injection drug works (such as cookers and cotton) which could have acted as vectors for HCV transmission. Increases in indicators of heroin and opioid use (see subsequent pages) are correlated with the rise in HCV cases in the young adult population (i.e. more substance use leading to more HCV transmission.

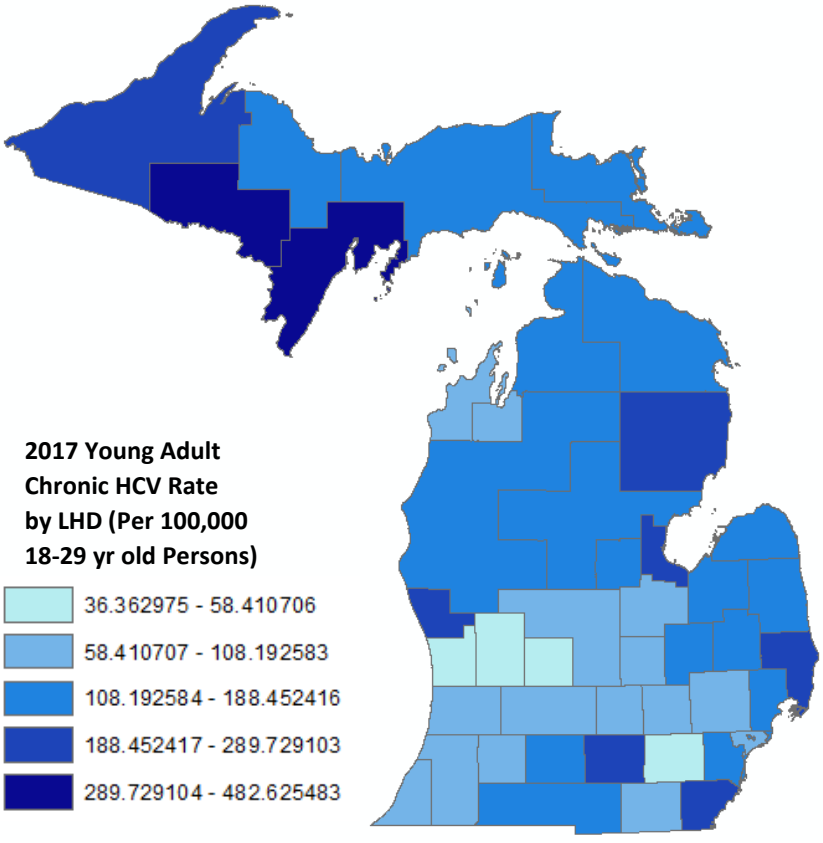
A demographic breakdown of the chronic HCV cases aged 18-29 years old who were diagnosed in 2017 (Table 9.2) shows that the vast majority were white, non-Hispanic, and non-Arab with an approximately even gender distribution. Where injection drug use information was available on these patients, 85.0% reported a history of IVDU.

Maps of the rates of 2017 chronic HCV cases among 18-29 year olds, 2017 heroin treatment admissions, and 2016 non-heroin opioid overdose deaths and heroin overdose deaths by county and local health jurisdiction can be found in the subsequent pages. More detailed information on hepatitis C infection in young adults can be found on the MDHHS viral hepatitis website and in the links below:

Young Adults with Hepatitis C Study Summary Report
Young Adults with Hepatitis C Study Fact Sheet
Emerging Epidemic of Hepatitis C Virus Infections Among Young Non-Urban Persons who Inject Drugs in the United States, 2006–2012. *Clin Infect Dis*. Aug 2014

Young Adult (18-29 years old) HCV Case Rate Maps by County and Local Health Jurisdiction





Drug Poisoning and Drug Treatment Data

Figure 10.1 Number Heroin Substance Abuse Treatments Admissions and Deaths in Michigan, 2000-2017

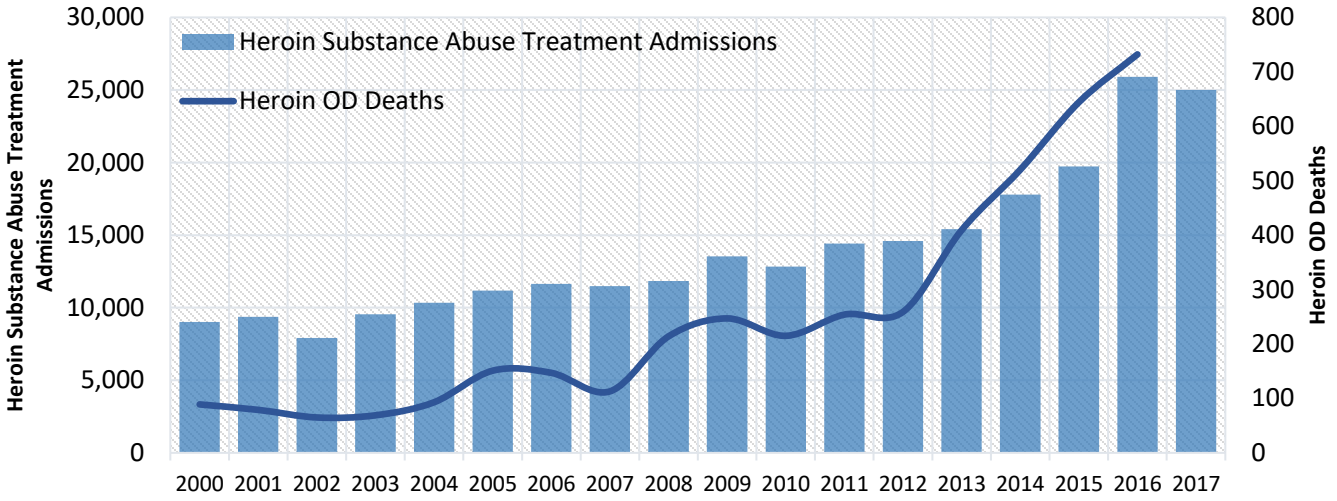


Table 10.1 Drug Overdose Deaths, Treatment Admissions and HCV in Michigan, 2000-2017

Year	All Drug Poisoning Deaths	Opioid OD Deaths	Heroin OD Deaths	Heroin Substance Abuse Treatment Admissions	Number of Chronic HepC Cases 18-29 Years Old
2000	581	74	89	9023	59
2001	611	88	79	9367	78
2002	744	148	65	7921	182
2003	757	150	69	9558	184
2004	858	228	93	10331	246
2005	971	296	151	11182	359
2006	1171	415	147	11642	482
2007	1219	360	113	11481	486
2008	1231	381	214	11843	649
2009	1416	424	247	13548	739
2010	1392	424	215	12836	882
2011	1,359	368	254	14,413	1,182
2012	1,300	389	259	14,596	1,244
2013	1,535	432	409	15,419	1,180
2014	1,745	481	520	17,800	1,437
2015	1,991	634	644	19,728	1,444
2016	2,376	1,001	732	25,910	2,060
2017	-	-	-	24,994	2,069

Table 10.1 depicts that Michigan has seen a parallel increase in the number of heroin overdose deaths and heroin substance abuse treatment admissions from 2000-2016. While overdose deaths continue to increase, number of treatment admissions decreased slightly from 2016 to 2017. Despite that decrease, treatment admissions still grew 177% from 9,023 in 2000 to 24,994 in 2017, while the number of heroin overdose deaths increased 722% from 89 in 2000 to 732 in 2016. Similarly, non-heroin opioid deaths have risen nearly every year from 74 in 2000 up by 1,235% to 1,001 in 2016. Total drug poisoning deaths rose 309% from 581 in 2000 to 2,376 in 2016.

Heroin overdose death data is obtained from Michigan Death Records. Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. The drug causing the poisoning can be specified or unspecified. Heroin deaths are those that specify a related ICD-10 cause code of T40.1. Opioid deaths are those with specified ICD-10 codes T40.2-T40.4, with no mention of T40.1 (heroin). All deaths may have other underlying or related causes.

Heroin substance abuse treatment admissions are obtained from the Treatment Episode Dataset (TEDS). A heroin admission is defined as any admission where heroin is self-identified as one of the top five substances responsible for the admission. These numbers represent unique admissions and not unique patients as patients can be admitted multiple times at different facilities.

Emergency Department Syndromic Surveillance Data

Emergency department syndromic surveillance system data can also be used as an indicator for injection drug and substance use in the population.

Emergency Department visit data possibly related to injection drug use are obtained through the Michigan Syndromic Surveillance System (MSSS). MSSS reporting is voluntary and not all hospitals participate in submitting ED data. The MSSS has been estimated to cover 83% of Michigan's population. Data are obtained by creating ad hoc queries of chief complaints (details below).

It is certainly possible that ED-related injection drug use complaints may be missed by the query and/or that we may be counting some ED complaints that are unrelated to injection drug use. With these limitations in mind, MSSS data can be an effective tool for monitoring ED-trends in a population over time. It is important to note that MSSS data can be influenced by changes in the quality of health facility reporting which may change over time. One large health system modified reporting to a more detailed message in late 2017, which largely explains the increase in November and December.

The following search terms are used to identify ED visits related to injection drug use:

OR: heroin heroine ivda ivdu idu "injection drug" opoid opiod opiate opioid suboxon fentan noloxone nalaxone naloxone narcan bupren speedball "speed ball" morphin "venous drug" methadone

NOT: epidural idual idue idus

There has been a 98% increase in the number of ED syndromic visits related to this query between 2013 and 2017 indicating that opioid and heroin related ED visits are on the rise.

Figure 11.1 Emergency Department Substance Abuse Encounters, Syndromic Surveillance System, Jan 2013-Dec 2017

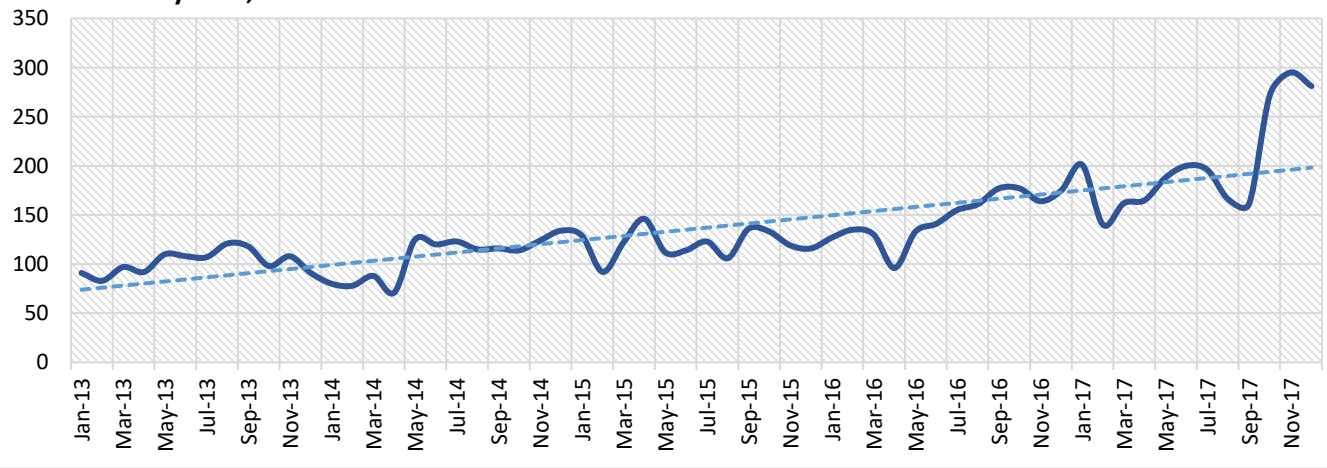
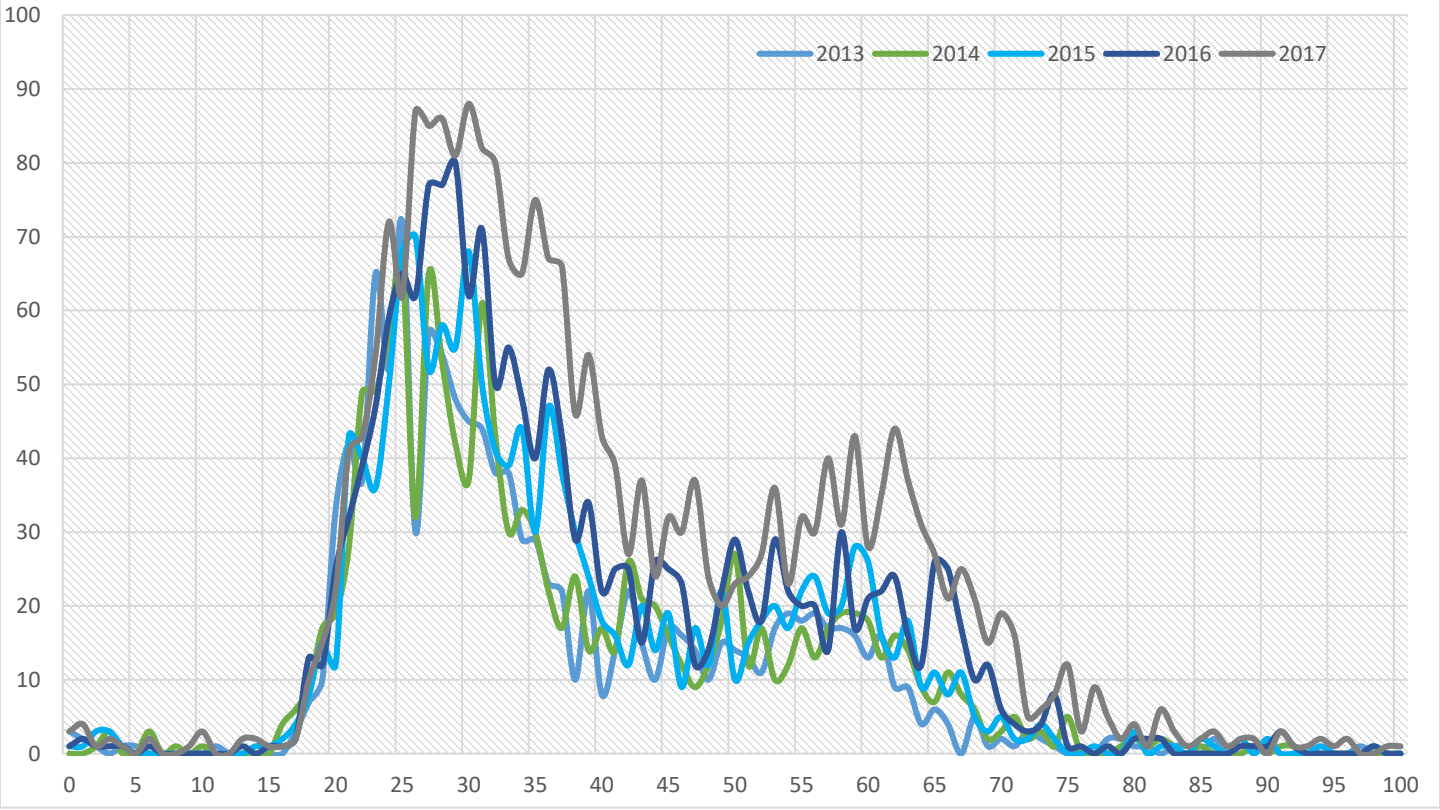
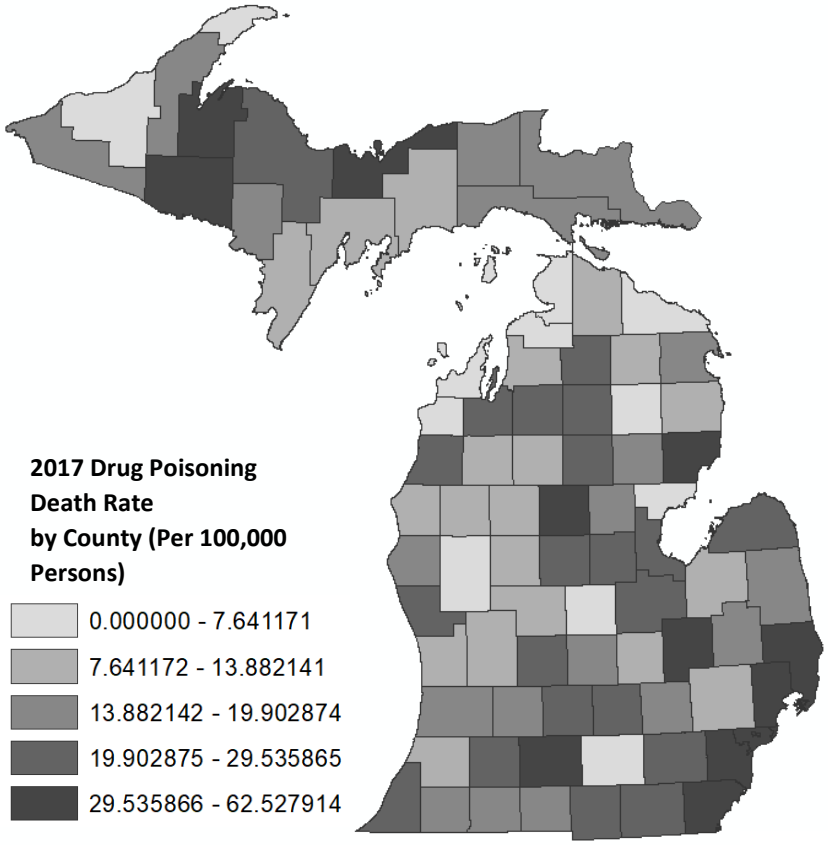


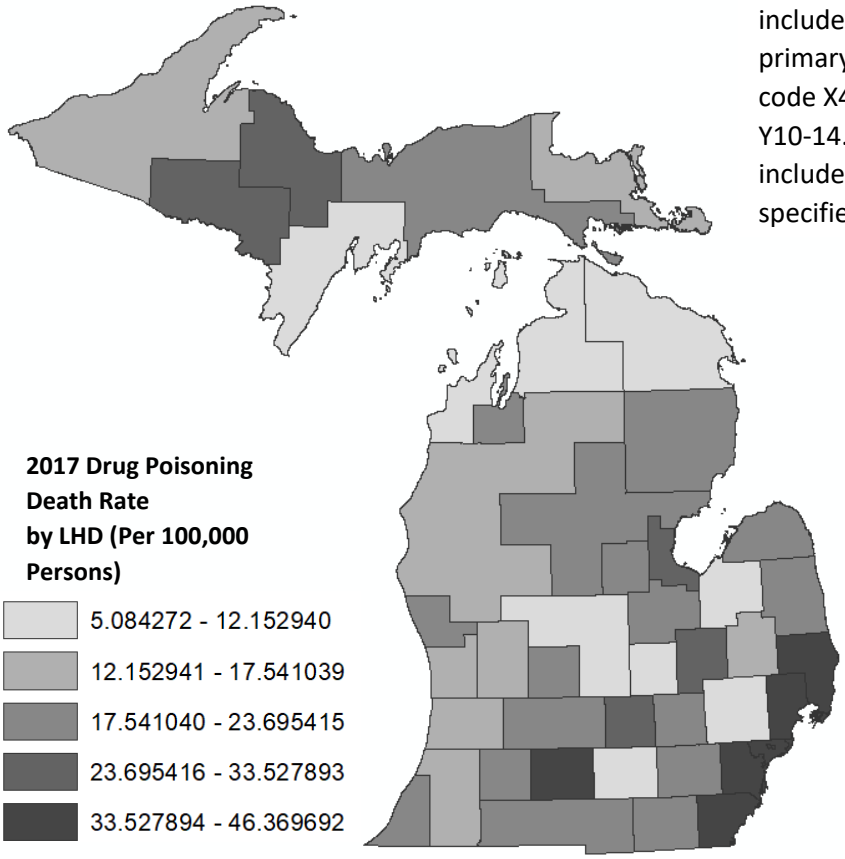
Figure 11.2 Emergency Department Substance Abuse Encounters, by Age Year, Syndromic Surevillance System, 2013-2017



When stratifying by age, the ED encounters related to our query appeared to occur more frequently in the young adult population than other age groups in years 2013 through 2017. This observation is consistent with trends and patterns of injection drug and opioid abuse in Michigan and subsequent risk for viral pathogens like HCV.

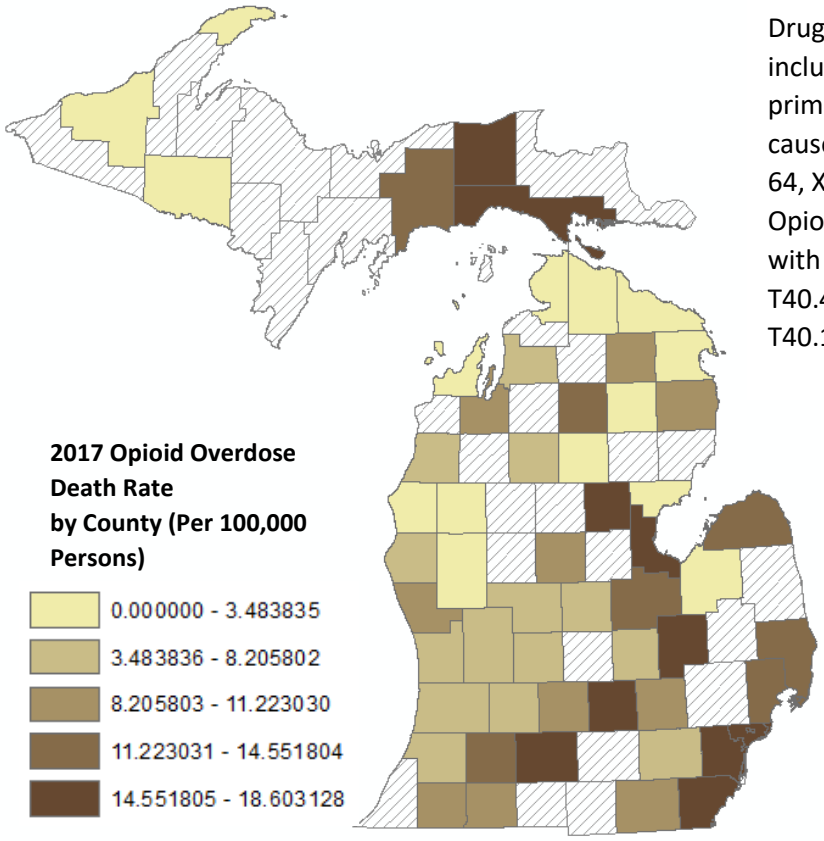
Total Drug Poisoning Death Rate Maps by County and Local Health Jurisdiction





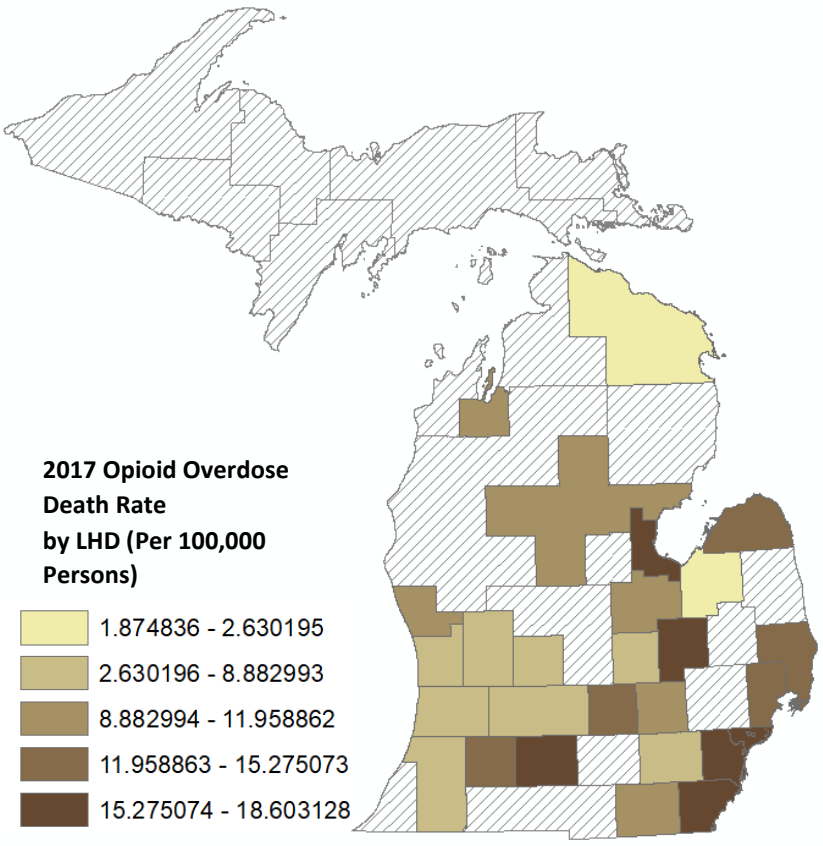
Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. These numbers include all specified and non-specified drugs.

Opioid Overdose Death Rate Maps by County and Local Health Jurisdiction

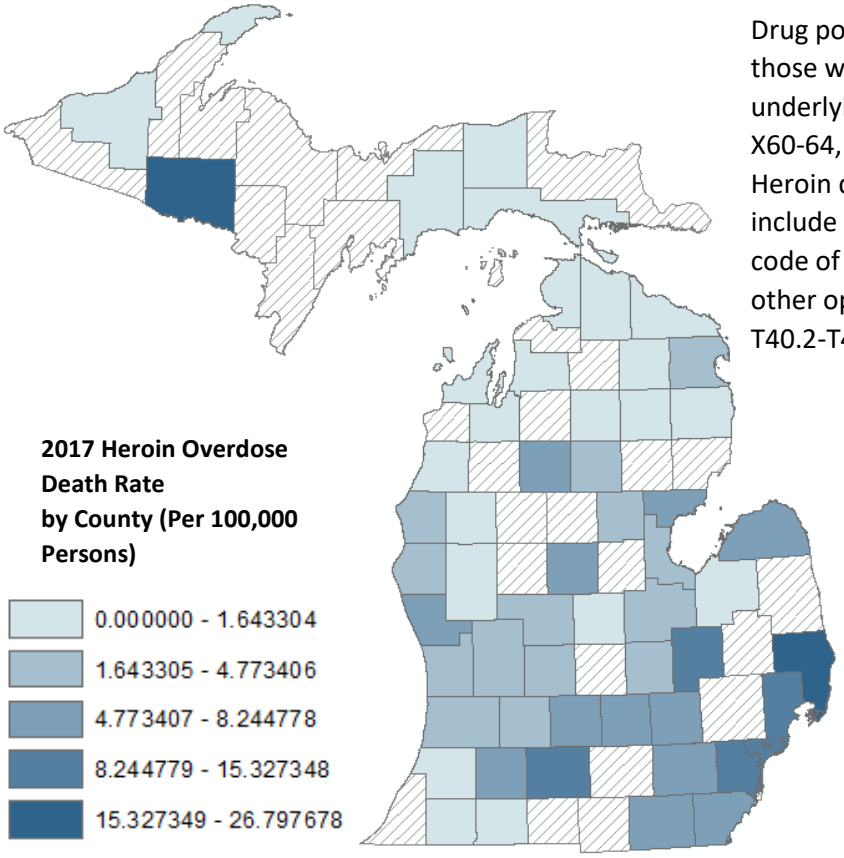


Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. Opioid deaths are those with ICD-10 codes T40.2-T40.4, with no mention of T40.1 (heroin).

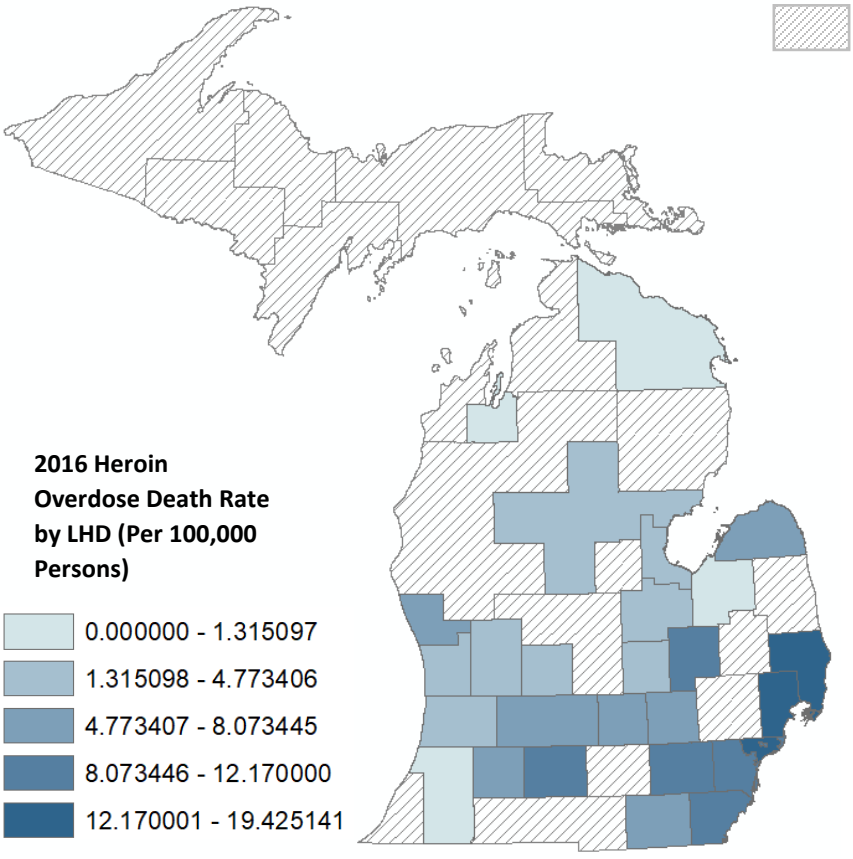
Data are suppressed if a drug is not specified in ≥80% of drug poisoning deaths



Heroin Overdose Death Rate Maps by County and Local Health Jurisdiction

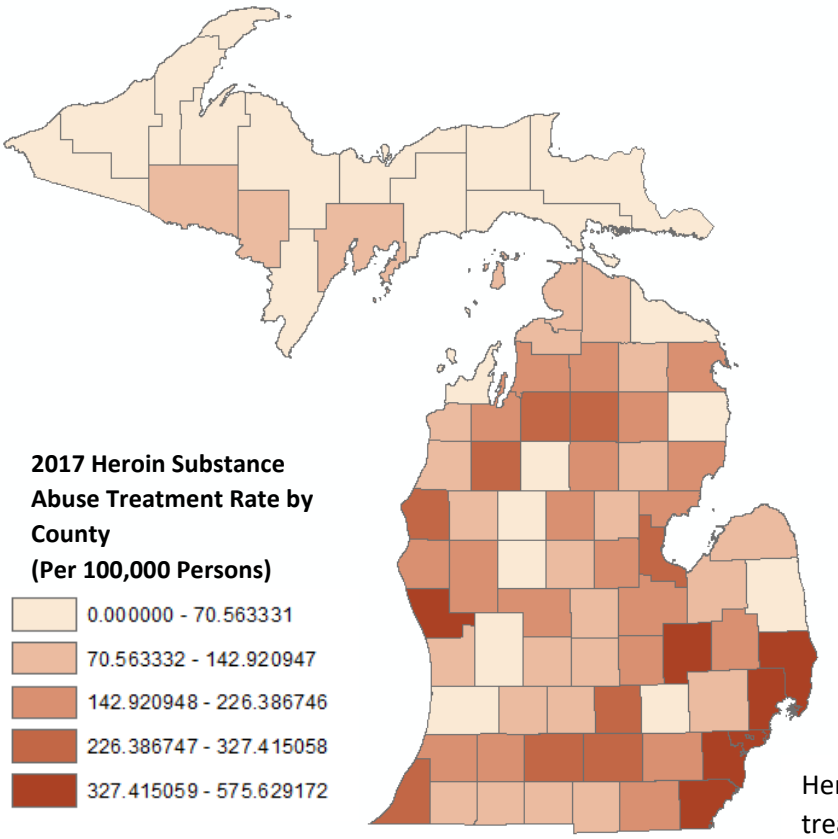


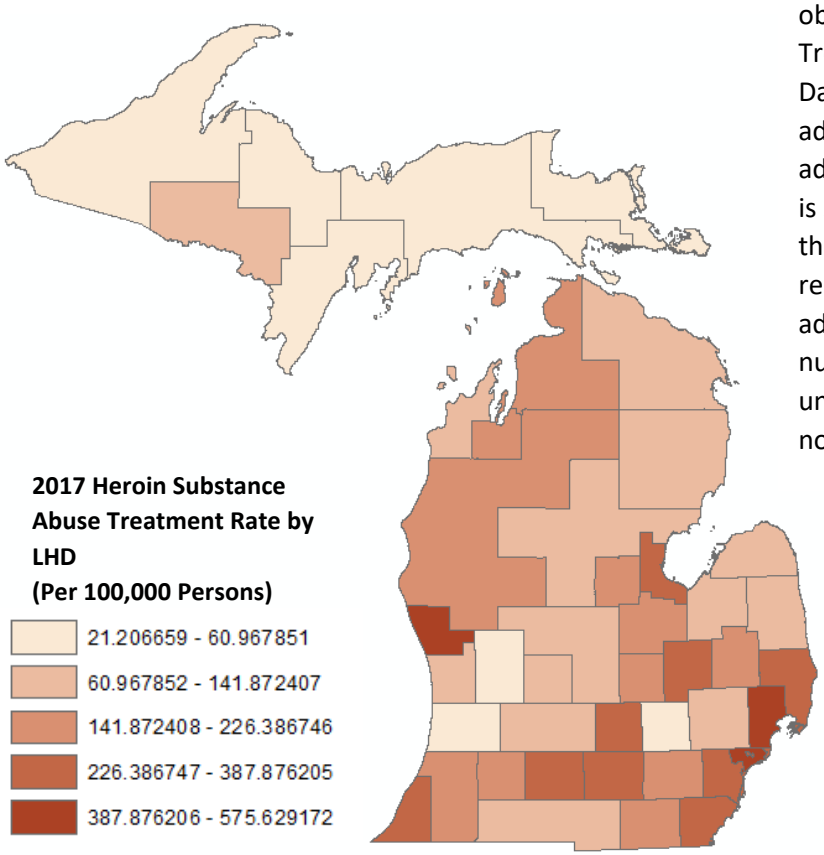
Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. Heroin deaths are those that include a related ICD-19 cause code of T40. With or without other opioids (ICD-10 codes T40.2-T40.4)



Data are suppressed if a drug is not specified in ≥80% of drug poisoning deaths

Treatment Episode Data Sets (TEDS) Rate Maps by County and Local Health Jurisdiction



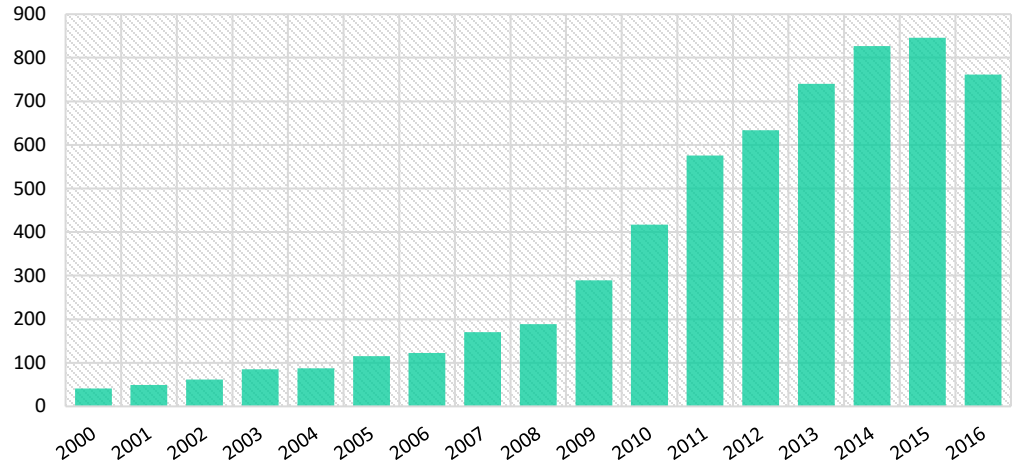


Heroin substance abuse treatment admissions are obtained from the Treatment Episode Dataset (TEDS). A heroin admission is any admission where heroin is self-identified as one of the top five substances responsible for the admission. These numbers represent unique admissions and not unique patients.

Neonatal Abstinence Syndrome (NAS)

Neonatal Abstinence Syndrome (NAS) occurs in infants who are exposed to opioids in the womb, before birth. These infants are born addicted to opioids and experience withdrawal symptoms after delivery. NAS typically occurs 48-72 hours after birth and symptoms include tremors, high-pitched crying, seizures, feeding difficulties and temperature instability. Babies born with NAS may have additional health problems such as birth defects, low birth weight, small head circumference and developmental and behavioral disorders. Infants born with NAS often face extended stays in the hospital after birth. Trends in NAS and areas in which NAS is common may indicate heightened risks, especially among reproductive-age women, for things like HIV, HCV, and subsequent perinatal HCV transmission.

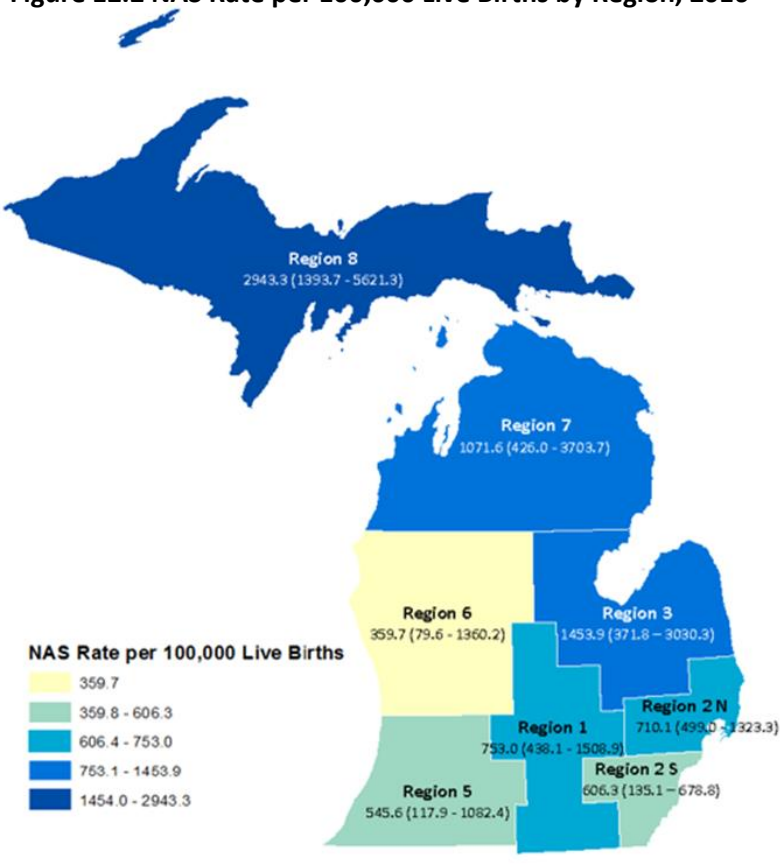
Figure 12.1 Rate of Treated Neonatal Abstinence Syndrome among Michigan Infants by Year, 2000-2016



NAS incidence has mirrored the increase in opioid abuse in Michigan (Figure 12.1). In 2000, the rate of treated NAS in Michigan infants (from the Michigan Inpatient Database) was 41.2 per 100,000 live births. The rate has increased steadily, peaking at a rate of 761.2 treated NAS cases per 100,000 live births in 2015, a 1747% increase.

Figure 12.2 NAS Rate per 100,000 Live Births by Region, 2016

This map depicts the 2016 NAS rate per 100,00 in each of the perinatal regions in Michigan. Region 8, the upper peninsula, has the highest rate of NAS at 2943.3 infants per 100,000 live births, while Region 6 has the lowest at 359.7 per 100,000 live births. This map was prepared by the Maternal and Child Health Epidemiology Section at MDHHS using data from the MDHHS Division of Vital Records and Health Statistics.

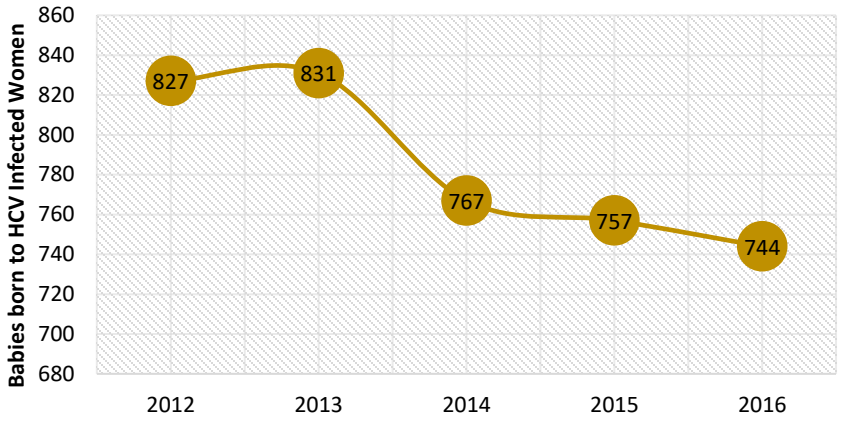


Perinatal Hepatitis C

MDHHS conducted a review of birth records matched with HCV infected women in MI, based on mother's name, from 2012-2016. This review provided insight on trends in the rate of infants born to HCV infected mothers and allowed for comparison of demographics and risk factors between HCV infected mothers vs non-infected mothers.

Although national data indicates an upward trend in birth to HCV infected mothers, statewide data shows a 10% decrease from 2012 through 2016 (figure 13.1).

Figure 13.1 Number of babies born to HCV Infected Mothers in Michigan, 2012-2016



A review of birth records indicates that women who give birth and were reported to be HCV infected are generally more likely than the non-infected population to:

- Be 20-29 years old
- Be Caucasian, American Indian or Multiracial
- Seek less prenatal care
- Be less educated
- Use Medicaid as payment for care
- Smoke
- Drink Alcohol
- Be single
- Be tested for HIV
- Self-report HCV
- Be infected with Hepatitis B Virus
- Have previous sexually transmitted disease(s)

Table 13.1 Demographics from Michigan Birth Records, 2012-2016

	Mother Reported for HCV in MDSS?			
Maternal Characteristic	**Yes (n= 3,926)**		**No (n=563,559)**	
Age Group (in Years)				
<20	188	*4.79%*	36,039	*6.39%*
20-29	2,509	*63.91%*	302,683	*53.71%*
30-39	1,139	*29.01%*	211,160	*37.47%*
40-49	89	*2.27%*	3,597	*0.64%*
>50	1	*0.03%*	53	*0.01%*
Race				
American Indian	75	*1.91%*	2,280	*0.40%*
Asian	24	*0.61%*	22,359	*3.97%*
African American	411	*10.47%*	104,319	*18.51%*
Caucasian	3,228	*82.22%*	408,467	*72.48%*
Other	66	*1.68%*	17,568	*3.12%*
Multiple Race	106	*2.70%*	10,038	*1.78%*
Unknown	16	*0.41%*	1,307	*0.23%*
Prenatal Care Visits				
Less than 8 or no care	981	*24.99%*	60,229	*10.69%*
8 or greater	2,808	*71.52%*	488,174	*86.62%*
Education				
High school graduate or lower	3,500	*89.15%*	351,373	*62.35%*
Higher degree	366	*9.32%*	208,349	*36.97%*
Paysource				
Medicaid	3,038	*77.38%*	243,480	*43.20%*
Private Insurance	783	*19.94%*	304,548	*54.04%*
Smoking				
Yes	2630	*66.99%*	100,801	*17.89%*
No	1,255	*31.97%*	457,527	*81.19%*
Married				
Yes	891	*22.69%*	329,148	*58.41%*
No	3,028	*77.13%*	234,256	*41.57%*
Self-Reported HCV				
Yes	1170	*29.80%*	294	*0.05%*
No	2,689	*68.49%*	556,412	*98.73%*

It is estimated that perinatal HCV infection occurs in 5 to 15% of babies born to HCV infected women. The number of women of childbearing age infected with HCV continues to rise as a result of the opioid and heroin epidemics. In fact, the rate of HCV in women aged 15-44 has surpassed that of the rest of Michigan's female population (Figure 13.2). Perinatal HCV, therefore, is becoming an increasingly important public health issue. There is no intervention to reduce the risk of vertical transmission of HCV as there is with perinatal HBV. It is not recommended to treat pregnant women for HCV infection. However, HCV direct acting antivirals are now approved to treat children as young as 12 years old.

From 2009-2014 the US has experienced an 89% increase in present HCV infections in women at the time of birth, increasing from 1.8 to 3.4 instances per 1,000 births. Michigan was estimated to have a rate of 2.6-5.0 HCV infections among pregnant women for every 1,000 live births in 2014. That estimates approximate the number of incident perinatal HCV cases in MI in 2014 to be in the range of 15 to 85 cases per year.

While there is no formal case definition for perinatal hepatitis C cases, the proposed case definition states that a perinatal hepatitis C case is between the ages of 2 months and 36 months old, and must have record of a positive HCV nucleic acid test (qualitative, quantitative, or genotype). Under this case definition, there were 23 instances of reported perinatal between 2012 and 2017, which is more than twice the number of perinatal HIV and HBV infections combined. The 23 perinatal HCV cases are likely an underestimation because an estimated 50-75% of the HCV infected population is undiagnosed, and infants are often not tested or tested inaccurately.

Figure 13.2 Number of Hepatitis C Cases per 100,000 Population, Women of Childbearing Age compared to Total Women, 2005-2017

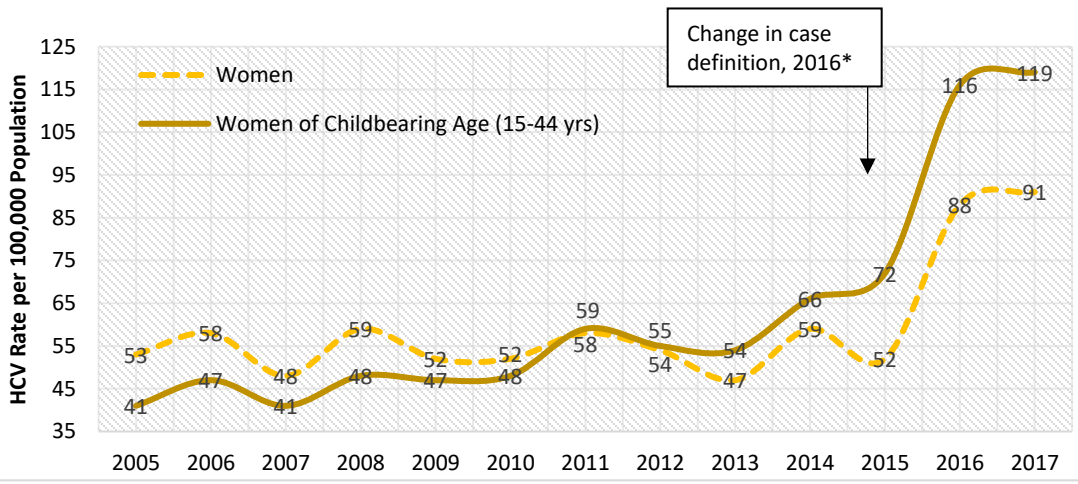
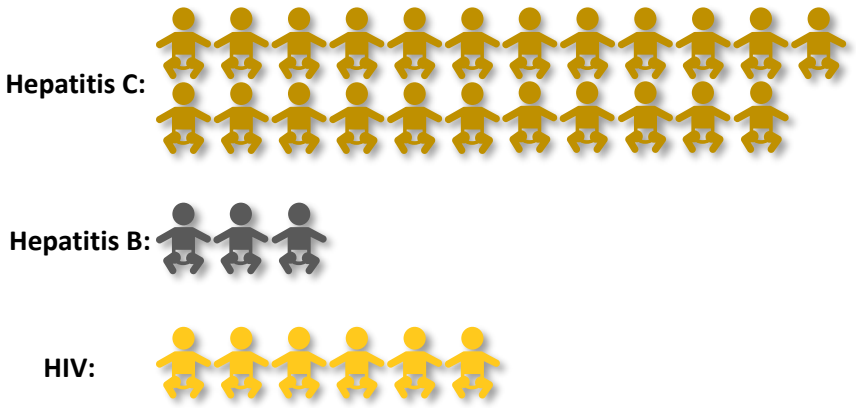


Figure 13.3 Identified Perinatal Infections, MDSS and eHARs, 2012-



Perinatal Hepatitis B

Perinatal HBV infection in a pregnant woman poses inherent risk to the infant at birth, as perinatal transmission is a known risk factor for HBV infection. CDC estimates the number of births to hepatitis B surface antigen (HBsAG) positive women by using prevalence of HBV infection by race/ethnicity as well as country of birth for mothers of infants. The current CDC estimation of expected birth to HBsAG positive women nationwide is 20,598 per year, and in the range of 309-461 per year in MI. However, less than half of the lower level of these estimated births are being identified.

Since 2016, MI has required physicians, health care providers and laboratories to report pregnancy status for all women of childbearing age (10 – 60 years of age). Identifying HBsAg-positive pregnant women prenatally is key in protecting babies from getting HBV. More than 98% of all babies, if treated appropriately, will be protected from getting HBV from their mothers. Hepatitis B (hepB) vaccine has been available in the U. S. since 1981 and has been proven to be safe and effective in preventing HBV transmission. CDC now recommends vaccination within 24 hours of birth for all medically stable babies, weighing more than 2,000 grams and born to HBsAg-negative women. CDC also recommends hepB vaccine and hepatitis B immune globulin (HBIG) within 12 hours of birth for all babies born to HBsAg-positive women.

The MDHHS Immunization Division Perinatal Hepatitis B Prevention Program (PHBPP)'s mission is to identify HBV infected pregnant women and coordinate proper care and treatment of the babies born to them. Even with our efforts to provide the appropriate prophylaxis, four babies born since 2010 were identified as being perinatally infected with HBV. From 2013 through 2014, the foreign-born proportion of women who were both infected and pregnant increased to 74%, compared to 59% in years 2008 through 2011. Furthermore, 43% of those women were identified as Asian/Pacific Islander in 2008-2011, increasing to 60% in 2013-2014.

Figure 14.1 MI's Perinatal Hepatitis B Prevention Program (PHBPP), 2012-2016

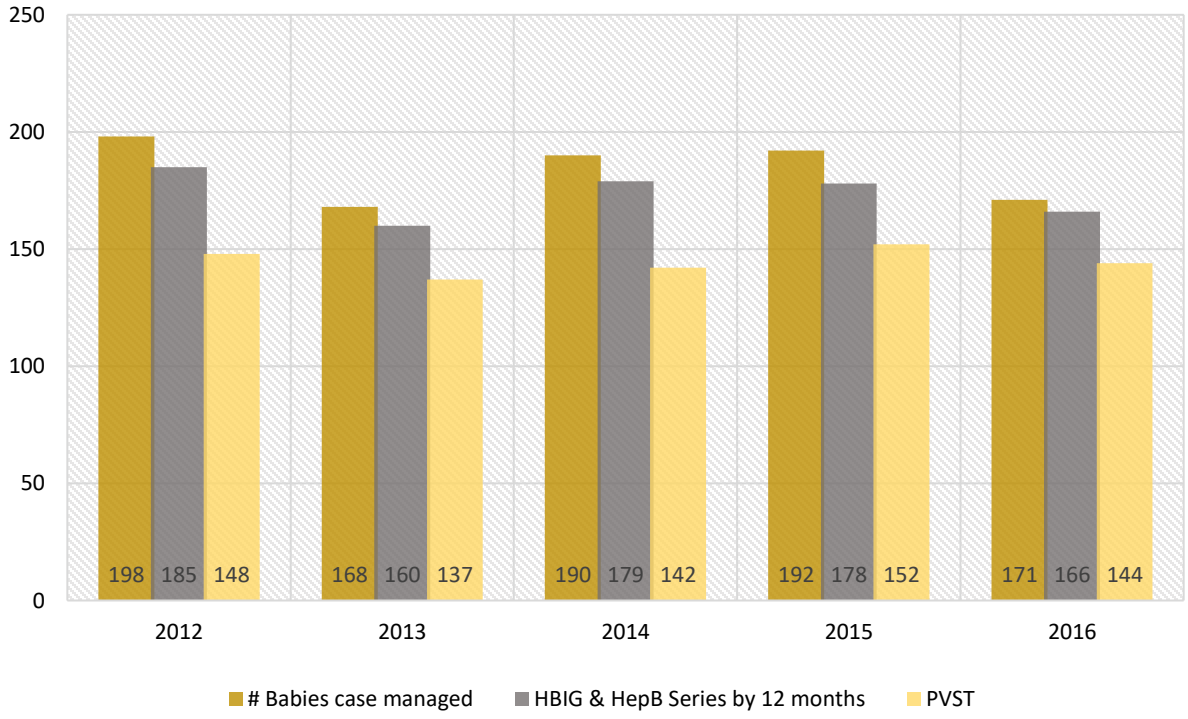


Table 14.1 Proportion of Infants Receiving HBV Treatment, Michigan and the United States, 2010-2016

	2010		2011		2012		2013		2014		2015		2016	
	MI	US	MI	US	MI	US	MI	US	MI	US	MI	US	MI	US
Percent of Infants Receiving PEP at Birth	99%	96%	98%	96%	99%	96%	100%	96%	100%	97%	99%	96%	99%	-
Percent of Infants with HBIG & Complete HepB Series by 12 Months	93%	84%	90%	84%	93%	84%	95%	84%	94%	82%	93%	83%	97%	-
Percent of Infants with PVST by End of Reporting Period 1	77%	60%	82%	61%	75%	63%	82%	65%	75%	64%	79%	63%	84%	-

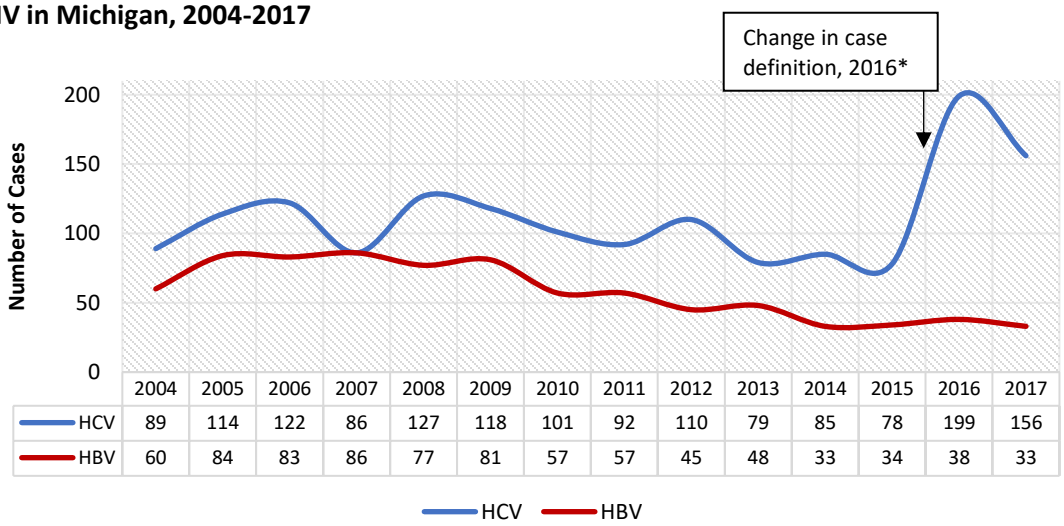
Infants who acquire HBV infection from their mothers at birth are 90% more likely to become chronically infected and 25% of these infants will have liver cancer or even die from the effects of having HBV. It is extremely important to identify all HBsAg-positive pregnant women prior to delivery so that their infants can receive HBIG and hepB vaccine within 12 hours of life for immediate protection against HBV. For life-long protection, these infants need at least two additional doses of hepB vaccine and a post-vaccination serologic test (PVST) at nine to twelve months of age. For more information, go to www.mi.gov/hepatitisB or call 800-964-4487.

The Michigan PHBPP consistently performs above the national average in care and treatment of infants born to HBV infected mothers. Although the proportion of infants getting care decreases as they age, the number of perinatal hepatitis B cases has remained very low in recent years.

Hepatitis and HIV Co-infections

Health outcomes for individuals with HIV/HBV or HIV/HCV co-infections are worse than individuals mono-infected with either of the viruses. In order to assess the burden of viral hepatitis and HIV co-infection in Michigan, MDHHS staff performed a match between HIV cases reported in the Enhanced HIV/AIDS Reporting System (eHARS) and viral hepatitis cases reported in the MDSS. Cases were matched by first name, last name and date of birth using LinkPlus, a probabilistic record-linkage software program publicly available from the CDC. Risk factors for HIV transmission were obtained from eHARS.

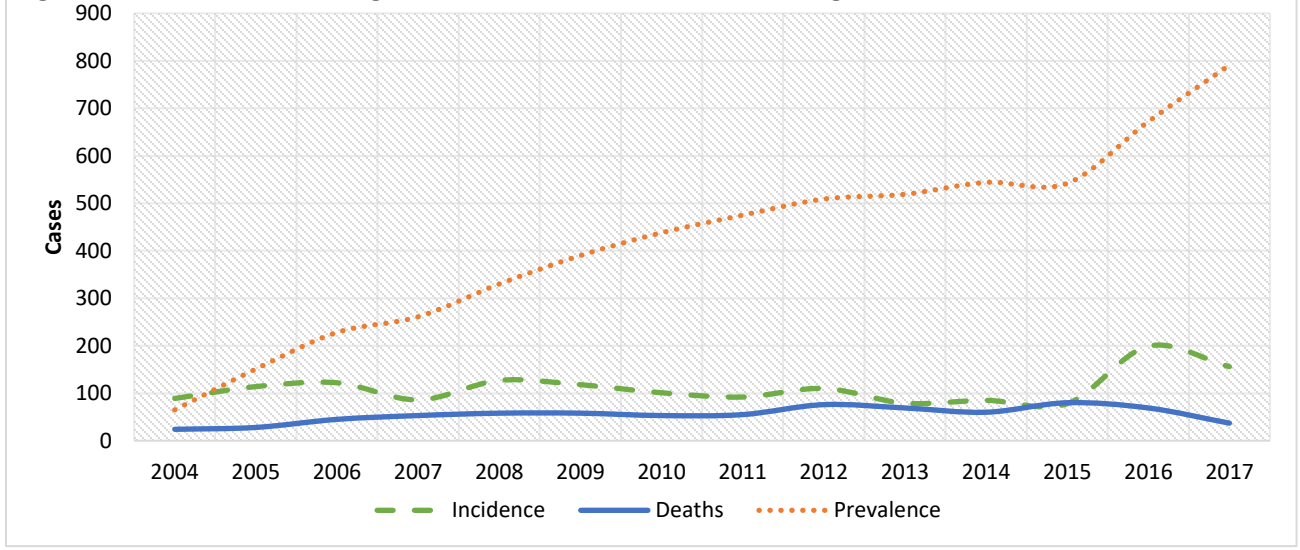
Figure 15.1 Count of Hepatitis B and Hepatitis C Cases Co-infected with HIV in Michigan, 2004-2017



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HCV	89	114	122	86	127	118	101	92	110	79	85	78	199	156
HBV	60	84	83	86	77	81	57	57	45	48	33	34	38	33

In general, the number of new HBV/HIV matches has trended downward in recent years. HIV/HCV matches also trended downward until 2016 when a new HCV case definition was instituted. This change is largely responsible for the increase in matches in 2016 and 2017. Most coinfected individuals are living longer (largely because of improvements in HIV linkage to care and viral suppression), resulting in increased prevalence of both co-infections (Figure 15.2). Tables 15.1 and 15.2 look at the demographic breakdown of both HBV/HIV and HCV/HIV co-infections. As one might suspect, HBV/HIV co-infection is more common among the MSM population and thus tends to be more male and younger in age. HCV/HIV co-infection is associated with intravenous drug use and follows of the demographics of intravenous drug users infected with HIV.

Figure 15.2 Prevalence of Diagnosed HCV-HIV Coinfections in Michigan, 2004 - 2017



Between 2004 and 2016, 783 people were reported in Michigan with HBV/HIV co-infection. Table 15.1 shows a breakdown of the HBV/HIV co-infected population in 2017. The 2017 cases are similar to the historical cases in regard to race and sex. MSM is the predominant risk factor in the HBV and HIV co-infected population with an age that tends to be over 30 years old.

Table 15.1 Hepatitis B and HIV Co-Infection Data in Michigan, 2017

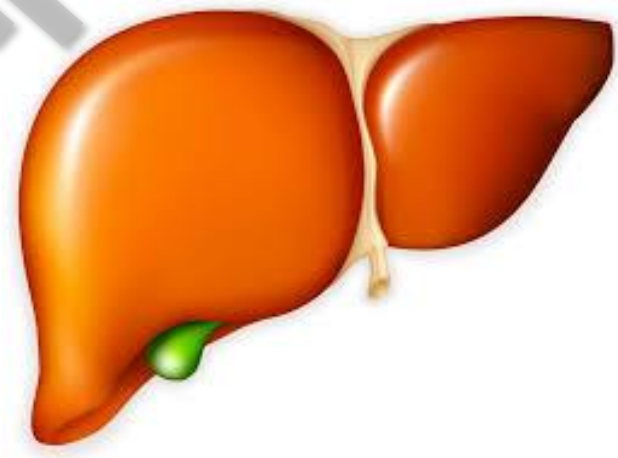
Variable	2017 HBV/HIV Co-infections		2004-2016 HBV/HIV Co-infections	
Total Co-infections	33		783	
Sex				
Male	28	*(84.8%)*	699	*(89.3%)*
Female	5	*(15.2%)*	84	*(10.7%)*
Unknown	0	*(0.0%)*	0	*(0.0%)*
Race				
Caucasian	10	*(30.3%)*	221	*(28.2%)*
Black or African American	21	*(63.6%)*	513	*(65.5%)*
Hispanic	1	*(3.0%)*	24	*(3.1%)*
Asian	0	*(0.0%)*	4	*(0.5%)*
American Indian or Alaskan Native	0	*(0.0%)*	1	*(0.1%)*
Multi/Other/Unknown	1	*(3.0%)*	20	*(2.6%)*
HIV Transmission Risk				
MSM	17	*(51.5%)*	474	*(60.5%)*
IDU	2	*(6.1%)*	73	*(9.3%)*
MSM/IDU	1	*(3.0%)*	42	*(5.4%)*
Blood Recipient	0	*(0.0%)*	4	*(0.5%)*
Heterosexual	3	*(9.1%)*	71	*(9.1%)*
Perinatal	0	*(0.0%)*	2	*(0.3%)*
Unknown/Undetermined	10	*(30.3%)*	117	*(14.9%)*
Age at Coinfection				
0-19	0	*(0.0%)*	8	*(1.0%)*
20-29	1	*(3.0%)*	92	*(11.7%)*
30-39	13	*(39.4%)*	207	*(26.4%)*
40-49	8	*(24.2%)*	284	*(36.3%)*
50-59	7	*(21.2%)*	153	*(19.5%)*
60+	4	*(12.1%)*	39	*(5.0%)*

Between 2004 and 2016, 1,400 people were reported in Michigan with HIV/HCV co-infection. Table 15.2 shows a breakdown of the HCV/HIV co-infected population in 2017. The 2017 cases are similar to the historical cases in regard to sex, but MSM was the predominant risk factor for HCV/HIV co-infection, and the age distribution has shifted slightly toward younger patients while Caucasian race was more common than in the past. In comparison, IDU was the predominant risk factor in the HCV and HIV co-infected population from 2004-2015, with an age generally over 30 years old. However, in recent years there has been a shift from IDU risk to MSM risk in this co-infected population. While sexual transmission of HCV is rare, it has been reported in HIV-infected MSM populations.

Table 15.2 Hepatitis C and HIV Co-Infection Data in Michigan, 2017

Variable	2017 HCV/HIV Co-infections		2004-2016 HCV/HIV Co-infections	
Total Co-infections	156		1,400	
Sex				
Male	118	*(75.6%)*	1,022	*(73.0%)*
Female	38	*(24.4%)*	369	*(26.4%)*
Unknown	0	*(0.0%)*	9	*(0.6%)*
Race				
Caucasian	66	*(42.3%)*	431	*(30.8%)*
Black or African American	78	*(50.0%)*	843	*(60.2%)*
Hispanic	3	*(1.9%)*	64	*(4.6%)*
Asian	1	*(0.6%)*	11	*(0.8%)*
American Indian or Alaskan Native	0	*(0.0%)*	1	*(0.1%)*
Multi/Other/Unknown	8	*(5.1%)*	50	*(3.6%)*
HIV Transmission Risk				
MSM	56	*(35.9%)*	308	*(22.0%)*
IDU	42	*(26.9%)*	594	*(42.4%)*
MSM/IDU	24	*(15.4%)*	173	*(12.4%)*
Blood Recipient	1	*(0.6%)*	41	*(2.9%)*
Heterosexual	16	*(10.3%)*	156	*(11.1%)*
Perinatal	0	*(0.0%)*	3	*(0.2%)*
Unknown/Undetermined	17	*(10.9%)*	125	*(8.9%)*
Age at Coinfection				
0-19	1	*(0.6%)*	10	*(0.7%)*
20-29	28	*(17.9%)*	86	*(6.1%)*
30-39	31	*(19.9%)*	186	*(13.3%)*
40-49	24	*(15.4%)*	422	*(30.1%)*
50-59	37	*(23.7%)*	525	*(37.5%)*
60+	35	*(22.4%)*	171	*(12.2%)*

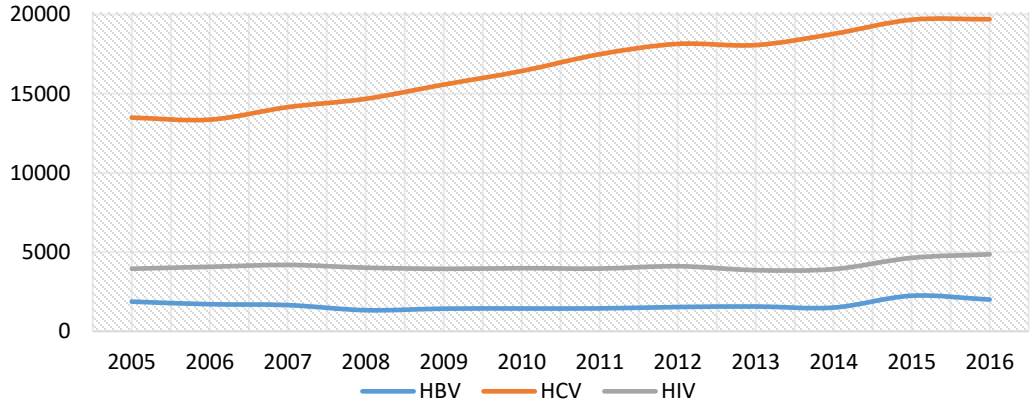
Viral Hepatitis Outcomes



Viral Hepatitis Hospitalizations and Liver Transplants

Trends in general hospitalization totals are also indicative of a marked increase in health complications as a result of HCV. Figure 16.1 indicates that hospitalizations attributed to HCV increased by nearly 46% from 2005 through 2016, while total hospitalizations due to HBV and HIV each stayed relatively steady. The magnitude of HCV-related hospitalizations is also staggering, at nearly four times as many admissions as HIV.

Figure 16.1 Hospitalizations Due to HBV, HCV and HIV, Michigan, 2005-2016

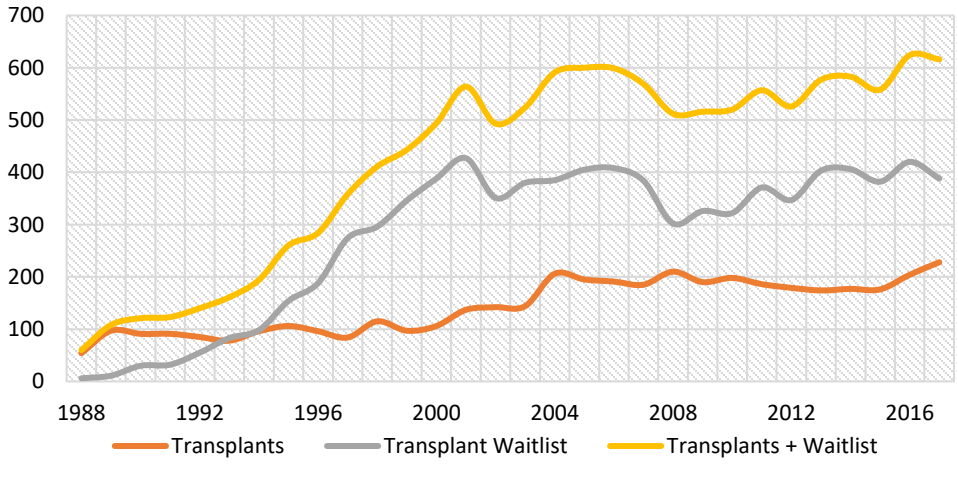


Note: Hospitalizations documenting hepatitis B include inpatient hospitalizations with ICD-9-CM codes for acute, chronic, or unspecified hepatitis B (07020, 07021, 07022, 07023, 07030, 07031, 07032, 07033, or V0261). Hospitalizations documenting hepatitis C include ICD-9-CM codes for acute, chronic, or unspecified hepatitis C (07041, 07044, 07054, 07059, 07070, 07071, or V0262). Hospitalizations documenting HIV include inpatient hospitalizations with ICD-9-CM codes 042, 07953, 79571, or V08.

Liver transplantation may be indicated for individuals with hepatocellular carcinoma (HCC). HBV and HCV infection increases the risk of development of HCC; therefore, trends in liver transplantation may be indicative of increasing disease progression and morbidity associated with long-term HBV and/or HCV carriage. However, these data should be interpreted with caution as there are many other indicators for liver transplantation independent of viral hepatitis (e.g. alcoholic cirrhosis).

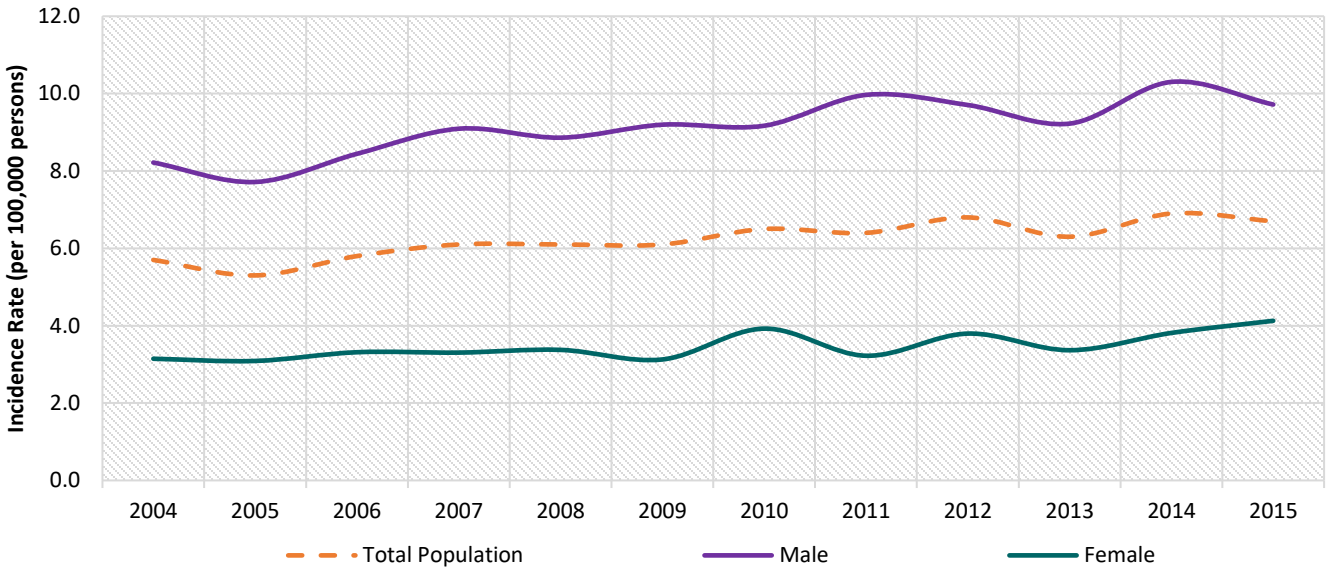
Counts of the number of individuals on the liver transplant waitlist and the number of liver transplants conducted in Michigan between 1988 and 2017 were requested through the United Network of Organ Sharing (UNOS, https://www.unos.org/).

Figure 16.2 Liver Transplants and Transplant Waitlist, Michigan, 1988-2017



Viral Hepatitis-Related Cancer & Mortality

Figure 16.3 Invasive Cancers of the Liver and Intrahepatic Bile Ducts in Michigan by Gender, 2004-2015



Viral hepatitis is a primary risk factor for the development of liver cancer. Figure 16.3 shows the age adjusted rate of liver and intrahepatic bile duct cancer by gender. The number of cases per year of liver and bile duct cancer have increased 46% between 2004 and 2015. African American males experience an incidence rate that is approximately 2.3 times higher, on average, than Caucasian males. The incidence rate for African American females tends to be similar to the state average, while Caucasian females have the lowest incidence rate of the specified race categories. Without improved efforts to test and treat persons with HBV and HCV infection, the rate of liver cancer may continue to rise, particularly as the population with greatest viral hepatitis prevalence ("Baby Boomers") ages.

Table 16.1 Incidence Rates of Invasive Cancers of the Liver and Intrahepatic Bile Ducts by Age-adjusted Rates of Race and Sex in Michigan, 2004-2015

Year of Diagnosis	Total		Caucasian Male		Caucasian Female		African American Male		African American Female	
	Incidence	Rate	Incidence	Rate	Incidence	Rate	Incidence	Rate	Incidence	Rate
2004	598	5.7	299	7.2	149	2.9	87	16.0	34	5.0
2005	572	5.3	290	6.9	142	2.8	80	13.5	36	5.2
2006	636	5.8	324	7.5	146	2.9	91	15.3	44	6.3
2007	679	6.1	346	8.0	161	3.1	103	16.8	34	4.8
2008	688	6.1	344	7.6	168	3.1	107	19.0	41	5.3
2009	706	6.1	361	7.9	154	2.9	116	18.8	36	4.7
2010	780	6.5	387	8.0	197	3.6	114	18.2	47	6.3
2011	767	6.4	419	8.8	156	2.9	122	18.3	42	5.5
2012	852	6.8	404	8.0	196	3.5	152	22.4	48	5.8
2013	797	6.3	404	7.9	173	3.0	133	18.8	48	6.0
2014	884	6.9	472	9.1	203	3.6	133	19.4	45	5.2
2015	874	6.7	448	8.5	206	3.6	130	19.2	66	7.6

Table 16.1 shows the rate of new cases of liver and intrahepatic bile duct cancer per year from 2004 to 2015 in Michigan per 100,000 people. The overall rate of liver and intrahepatic bile duct cancer in Michigan was 6.7 per 100,000 in 2015. African American males had an incidence rate of 19.2 per 100,000, which was 126% higher than that of Caucasian males (8.5 per 100,000). The incidence rate in African American females (7.6) was just over twice that of Caucasian females (3.6) in 2015.

Figure 16.4 Mortality Due to Invasive Cancer of the Liver and Intrahepatic Bile Ducts and Age-Adjusted Death Rates by Race and Sex in Michigan, 2004 - 2016

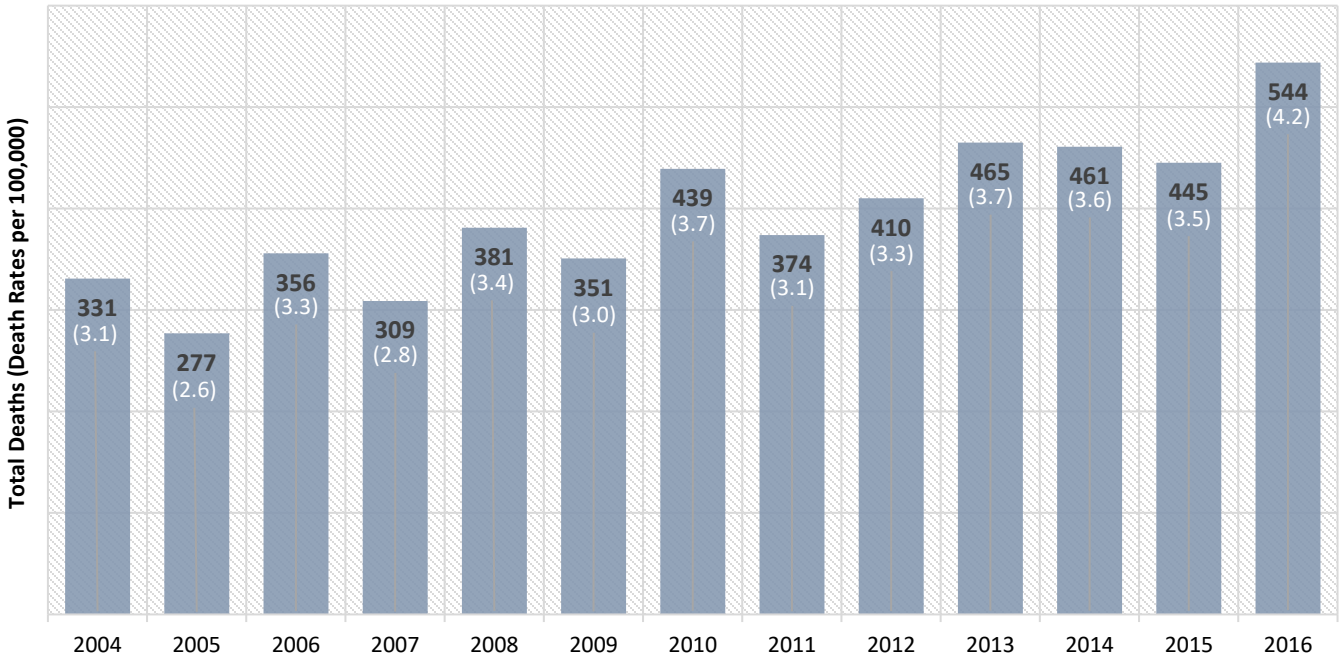


Figure 16.4 shows the number of deaths per year due to liver and intrahepatic bile duct cancer. This total has risen 64% from 2004 to 2016. Chronic infection with viral hepatitis, over time, can lead to liver cancer. As rates of liver cancer increase, we have observed a subsequent increase in mortality associated with liver cancer. Improved efforts to test and treat viral hepatitis infections may help reverse these trends.

Table 16.2 Numbers of Deaths Due to Invasive Cancer of the Liver and Intrahepatic Bile Ducts and Age-Adjusted Death Rates by Race and Sex in Michigan, 2004 - 2016

Year of Death	Total		Caucasian Male		Caucasian Female		African American Male		African American Female	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
2004	331	3.1	158	3.8	100	2	37	6.6	13	*
2005	277	2.6	139	3.3	76	1.5	39	7	11	*
2006	356	3.3	180	4.3	95	1.9	47	8.4	21	2.9
2007	309	2.8	150	3.5	85	1.6	40	6.5	18	*
2008	381	3.4	200	4.6	113	2.1	35	6	16	*
2009	351	3	170	3.8	84	1.6	58	9.3	15	*
2010	439	3.7	214	4.5	120	2.1	66	10.7	15	*
2011	374	3.1	197	4.1	91	1.6	63	10.2	17	*
2012	410	3.3	197	4.1	112	2	59	8.9	17	*
2013	465	3.7	227	4.5	129	2.2	65	9.3	27	3.4
2014	461	3.6	226	4.4	119	2.1	64	8.9	36	4.3
2015	445	3.5	218	4.2	121	2.1	60	9.9	26	3.1
2016	544	4.2	291	5.6	138	2.4	54	7.8	38	4.4

Table 16.2 shows the death rate per 100,000 Michigan population due to cancer of the liver and intrahepatic bile ducts between 2004 and 2016. The liver and intrahepatic bile duct cancer mortality rate in Michigan in 2016 was 4.2 per 100,000. African American males show the highest death rates due to these cancers as rates have increased by 18% between 2004 and 2016. The death rate in African American males (7.8 per 100,000) is 39% higher than the rate in Caucasian males (5.6 per 100,000). The death rate in Caucasian males has increased by 47% during between 2004 and 2016 while the death rate in Caucasian females has increased by only 20%.

While not all liver cancers are a direct result of viral hepatitis, viral hepatitis remains a primary risk factor for development of liver cancer. These data highlight racial disparities in liver cancer data that may be reflective of disparities seen in viral hepatitis infection.

Figure 16.5 Deaths Due to Acute and Chronic HCV, Michigan, 2005-2016

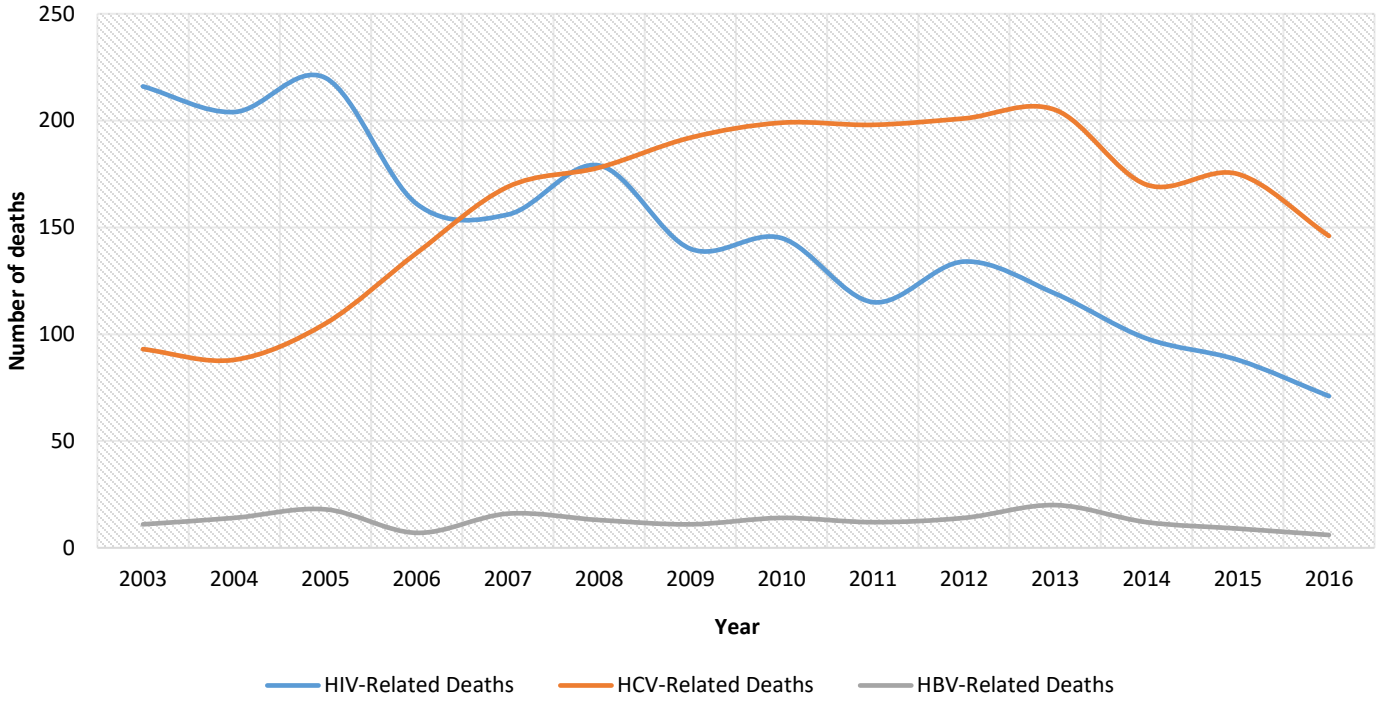


Figure 16.5 shows the number of deaths per year in Michigan residents between 2003 and 2016 due to acute and chronic HCV, according to death certificate data, in comparison to hepatitis B and HIV. The Vital Records and Health Statistics Section provides data on underlying causes of death in Michigan, which is classified using the Tenth Revision of the International Classification of Diseases (ICD-10).

In 2016 there were 146 deaths attributed to HCV in Michigan (ICD-10: B17.1, B18.2, B19.2). Between 2003 and 2016, deaths due to chronic HCV increased by 57%. The number of deaths decreased between 2013 and 2016, perhaps due to the introduction of new medications that treat HCV infections. From 2003 through 2016, HBV deaths (ICD-10: B16.2, B16.9, B18.1) decreased from 11 to 6, while HIV related deaths (ICD-10: B20-B24) were reduced by approximately 67%.

Appendices

Appendix A1: County Hepatitis Data

County	Total Population	2017 Chronic HCV Cases	2017 Acute HCV Cases	2017 Chronic HBV Cases	2017 Acute HBV Cases	2017 Chronic HCV Rate*	2017 Acute HCV Rate*	2017 Chronic HBV Rate*	2017 Acute HBV Rate*
Alcona	10,352	4	0	0	0	38.64	0.00	0.00	0.00
Alger	9,219	10	0	0	0	108.47	0.00	0.00	0.00
Allegan	115,548	77	0	4	1	66.64	0.00	3.46	0.87
Alpena	28,704	14	2	0	0	48.77	6.97	0.00	0.00
Antrim	23,144	23	2	2	1	99.38	8.64	8.64	4.32
Arenac	15,122	16	0	1	1	105.81	0.00	6.61	6.61
Baraga	8,503	25	0	0	0	294.01	0.00	0.00	0.00
Barry	59,702	45	0	2	0	75.37	0.00	3.35	0.00
Bay	104,747	118	6	3	0	112.65	5.73	2.86	0.00
Benzie	17,572	12	0	1	0	68.29	0.00	5.69	0.00
Berrien	154,010	151	5	6	0	98.05	3.25	3.90	0.00
Branch	43,427	43	0	1	0	99.02	0.00	2.30	0.00
Calhoun	134,386	182	4	14	2	135.43	2.98	10.42	1.49
Cass	51,599	47	1	1	0	91.09	1.94	1.94	0.00
Charlevoix	26,174	23	1	0	0	87.87	3.82	0.00	0.00
Cheboygan	25,401	32	0	0	0	125.98	0.00	0.00	0.00
Chippewa	37,724	42	2	0	0	111.33	5.30	0.00	0.00
Clare	30,358	25	1	1	0	82.35	3.29	3.29	0.00
Clinton	77,888	26	1	5	1	33.38	1.28	6.42	1.28
Crawford	13,744	6	0	0	0	43.66	0.00	0.00	0.00
Delta	36,202	58	5	5	0	160.21	13.81	13.81	0.00
Detroit City	672,829	1,940	8	237	11	288.33	1.19	35.22	1.63
Dickinson	25,535	43	5	1	0	168.40	19.58	3.92	0.00
Eaton	109,160	106	1	8	0	97.11	0.92	7.33	0.00
Emmet	33,182	24	0	0	0	72.33	0.00	0.00	0.00
Genesee	408,615	647	9	38	4	158.34	2.20	9.30	0.98
Gladwin	25,122	35	0	2	0	139.32	0.00	7.96	0.00
Gogebic	15,243	18	1	0	0	118.09	6.56	0.00	0.00
Grand Traverse	92,084	65	6	5	1	70.59	6.52	5.43	1.09
Gratiot	41,202	16	0	0	0	38.83	0.00	0.00	0.00
Hillsdale	45,774	53	0	1	1	115.79	0.00	2.18	2.18
Houghton	36,555	30	1	3	0	82.07	2.74	8.21	0.00
Huron	31,481	23	1	1	0	73.06	3.18	3.18	0.00
Ingham	288,051	351	9	45	1	121.85	3.12	15.62	0.35
Ionia	64,232	49	5	2	0	76.29	7.78	3.11	0.00
Iosco	25,327	41	1	4	0	161.88	3.95	15.79	0.00
Iron	11,195	30	0	0	0	267.98	0.00	0.00	0.00
Isabella	71,282	58	1	3	1	81.37	1.40	4.21	1.40
Jackson	158,460	162	4	6	0	102.23	2.52	3.79	0.00
Kalamazoo	261,654	259	1	19	1	98.99	0.38	7.26	0.38
Kalkaska	17,263	19	0	0	0	110.06	0.00	0.00	0.00
Kent	642,173	564	9	106	0	87.83	1.40	16.51	0.00
Keweenaw	2,199	2	0	0	0	90.95	0.00	0.00	0.00

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

County	Total Population	2017 Chronic HCV Cases	2017 Acute HCV Cases	2017 Chronic HBV Cases	2017 Acute HBV Cases	2017 Chronic HCV Rate*	2017 Acute HCV Rate*	2017 Chronic HBV Rate*	2017 Acute HBV Rate*
Lake	11,496	22	1	0	0	191.37	8.70	0.00	0.00
Lapeer	88,340	82	0	3	1	92.82	0.00	3.40	1.13
Leelanau	21,765	14	0	2	0	64.32	0.00	9.19	0.00
Lenawee	98,504	81	2	1	0	82.23	2.03	1.02	0.00
Livingston	188,624	117	1	10	3	62.03	0.53	5.30	1.59
Luce	6,358	15	0	1	0	235.92	0.00	15.73	0.00
Mackinac	10,820	12	1	1	0	110.91	9.24	9.24	0.00
Macomb	867,730	896	49	108	5	103.26	5.65	12.45	0.58
Manistee	24,373	21	0	1	0	86.16	0.00	4.10	0.00
Marquette	66,435	85	5	2	0	127.94	7.53	3.01	0.00
Mason	28,876	22	0	1	0	76.19	0.00	3.46	0.00
Mecosta	43,221	24	0	4	0	55.53	0.00	9.25	0.00
Menominee	23,281	33	1	0	0	141.75	4.30	0.00	0.00
Midland	83,462	65	1	4	0	77.88	1.20	4.79	0.00
Missaukee	15,102	11	0	0	0	72.84	0.00	0.00	0.00
Monroe	149,208	253	4	8	1	169.56	2.68	5.36	0.67
Montcalm	62,974	62	0	0	0	98.45	0.00	0.00	0.00
Montmorency	9,173	7	0	0	0	76.31	0.00	0.00	0.00
Muskegon	173,408	264	12	8	2	152.24	6.92	4.61	1.15
Newaygo	47,938	51	1	0	1	106.39	2.09	0.00	2.09
Oakland	1,243,970	1,010	9	176	3	81.19	0.72	14.15	0.24
Oceana	26,027	30	0	1	0	115.26	0.00	3.84	0.00
Ogemaw	20,904	31	1	3	1	148.30	4.78	14.35	4.78
Ontonagon	5,911	5	0	0	0	84.59	0.00	0.00	0.00
Osceola	23,110	19	0	1	0	82.22	0.00	4.33	0.00
Oscoda	8,264	19	0	2	2	229.91	0.00	24.20	24.20
Otsego	24,470	21	0	0	1	85.82	0.00	0.00	4.09
Ottawa	282,250	129	2	19	0	45.70	0.71	6.73	0.00
Presque Isle	12,762	19	0	0	0	148.88	0.00	0.00	0.00
Roscommon	23,700	35	1	1	0	147.68	4.22	4.22	0.00
Saginaw	192,326	190	0	16	1	98.79	0.00	8.32	0.52
St Clair	159,587	270	16	16	2	169.19	10.03	10.03	1.25
St Joseph	60,853	56	0	3	0	92.03	0.00	4.93	0.00
Sanilac	41,409	35	2	1	0	51.05	2.92	1.46	0.00
Schoolcraft	8,001	7	1	1	1	4.39	0.63	0.63	0.63
Shiawassee	68,554	46	0	4	1	75.59	0.00	6.57	1.64
Tuscola	53,338	45	1	9	0	84.37	1.87	16.87	0.00
Van Buren	75,223	114	1	1	0	151.55	1.33	1.33	0.00
Washtenaw	364,709	219	5	62	1	60.05	1.37	17.00	0.27
Wayne	1,076,537	1,360	20	217	11	126.33	1.86	20.16	1.02
Wexford	33,163	42	2	0	0	126.65	6.03	0.00	0.00
MDOC	41,122	703	3	22	1	1,709.55	7.30	53.50	2.43
State-wide†	9,928,300	12,062	234	1,237	64	121.49	2.36	12.46	0.64

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

Appendix A2: Heroin Data by County

County	Total Population	Young Adult (18-29) Population	2017 Young Adult (18-29) HCV Cases	2017 Heroin Treatment Admissions	2016 Heroin Overdose Deaths	2017 Young Adult (18-29) HCV Rate*	2017 Heroin Treatment Admission Rate*	2016 Heroin Overdose Death Rate*
Alcona	10,352	882	1	5	0	113.38	48.30	0.00
Alger	9,219	1,130	0	6	0	0.00	65.08	0.00
Allegan	115,548	15,677	14	29	4	89.30	25.10	3.46
Alpena	28,704	3,572	4	43	1	111.98	149.80	3.48
Antrim	23,144	2,517	4	35	0	158.92	151.23	0.00
Arenac	15,122	1,775	4	31	1	225.35	205.00	6.61
Baraga	8,503	1,203	11	6	0	914.38	70.56	0.00
Barry	59,702	7,931	3	53	2	37.83	88.77	3.35
Bay	104,747	14,805	33	303	5	222.90	289.27	4.77
Benzie	17,572	1,987	3	23	0	150.98	130.89	0.00
Berrien	154,010	21,955	23	461	14	104.76	299.33	9.09
Branch	43,427	5,869	10	55	0	170.39	126.65	0.00
Calhoun	134,386	20,392	34	440	16	166.73	327.42	11.91
Cass	51,599	6,650	5	52	0	75.19	100.78	0.00
Charlevoix	26,174	3,016	4	29	0	132.63	110.80	0.00
Cheboygan	25,401	2,836	8	27	0	282.09	106.30	0.00
Chippewa	37,724	6,994	10	8	0	142.98	21.21	0.00
Clare	30,358	3,790	4	61	0	105.54	200.94	0.00
Clinton	77,888	11,332	7	58	4	61.77	74.47	5.14
Crawford	13,744	1,445	3	39	0	207.61	283.76	0.00
Delta	36,202	4,246	22	27	0	518.13	74.58	0.00
Detroit City	672,829	129,856	124	3,873	104	95.49	575.63	15.46
Dickinson	25,535	3,068	10	30	1	325.95	117.49	3.92
Eaton	109,160	16,666	18	133	9	108.00	121.84	8.24
Emmet	33,182	4,398	4	40	0	90.95	120.55	0.00
Genesee	408,615	61,554	116	1,516	47	188.45	371.01	11.50
Gladwin	25,122	2,749	7	32	1	254.64	127.38	3.98
Gogebic	15,243	2,084	9	7	0	431.86	45.92	0.00
Grand Traverse	92,084	13,059	12	163	1	91.89	177.01	1.09
Gratiot	41,202	7,263	4	43	0	55.07	104.36	0.00
Hillsdale	45,774	6,859	10	47	3	145.79	102.68	6.55
Houghton	36,555	9,840	11	12	0	111.79	32.83	0.00
Huron	31,481	3,648	5	37	2	137.06	117.53	6.35
Ingham	288,051	79,177	64	870	21	80.83	302.03	7.29
Ionia	64,232	10,396	6	61	3	57.71	94.97	4.67
Iosco	25,327	2,716	9	41	1	331.37	161.88	3.95
Iron	11,195	1,076	10	16	3	929.37	142.92	26.80
Isabella	71,282	25,590	21	76	4	82.06	106.62	5.61
Jackson	158,460	24,437	48	456	2	196.42	287.77	1.26
Kalamazoo	261,654	59,702	45	477	20	75.37	182.30	7.64
Kalkaska	17,263	2,098	4	52	0	190.66	301.22	0.00
Kent	642,173	114,705	67	305	25	58.41	47.49	3.89
Keweenaw	2,199	198	0	0	0	0.00	0.00	0.00

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

County	Total Population	Young Adult (18-29) Population	2017 Young Adult (18-29) HCV Cases	2017 Heroin Treatment Admissions	2016 Heroin Overdose Deaths	2017 Young Adult (18-29) HCV Rate*	2017 Heroin Treatment Admission Rate*	2016 Heroin Overdose Death Rate*
Lake	11,496	1,136	0	9	0	0.00	78.29	0.00
Lapeer	88,340	11,946	14	141	4	117.19	159.61	4.53
Leelanau	21,765	2,288	1	10	0	43.71	45.95	0.00
Lenawee	98,504	14,844	13	223	7	87.58	226.39	7.11
Livingston	188,624	25,247	21	115	11	83.18	60.97	5.83
Luce	6,358	871	4	0	0	459.24	0.00	0.00
Mackinac	10,820	1,153	2	4	0	173.46	36.97	0.00
Macomb	867,730	131,735	154	4,331	133	116.90	499.12	15.33
Manistee	24,373	3,137	9	19	0	286.90	77.96	0.00
Marquette	66,435	13,918	24	37	0	172.44	55.69	0.00
Mason	28,876	3,649	8	79	1	219.24	273.58	3.46
Mecosta	43,221	10,940	2	18	1	18.28	41.65	2.31
Menominee	23,281	2,674	6	4	1	224.38	17.18	4.30
Midland	83,462	12,328	15	158	3	121.67	189.31	3.59
Missaukee	15,102	1,958	1	10	1	51.07	66.22	6.62
Monroe	149,208	20,856	51	561	15	244.53	375.99	10.05
Montcalm	62,974	8,859	13	109	3	146.74	173.09	4.76
Montmorency	9,173	823	1	8	0	121.51	87.21	0.00
Muskegon	173,408	26,163	54	777	14	206.40	448.08	8.07
Newaygo	47,938	6,436	8	70	0	124.30	146.02	0.00
Oakland	1,243,970	182,782	132	1,588	21	72.22	127.66	1.69
Oceana	26,027	3,358	7	42	1	208.46	161.37	3.84
Ogemaw	20,904	2,387	5	28	0	209.47	133.95	0.00
Ontonagon	5,911	412	0	0	0	0.00	0.00	0.00
Osceola	23,110	2,975	5	15	1	168.07	64.91	4.33
Oscoda	8,264	918	5	18	0	544.66	217.81	0.00
Otsego	24,470	3,311	6	51	0	181.21	208.42	0.00
Ottawa	282,250	55,001	20	293	9	36.36	103.81	3.19
Presque Isle	12,762	1,176	2	5	0	170.07	39.18	0.00
Roscommon	23,700	2,230	5	48	1	224.22	202.53	4.22
Saginaw	192,326	31,559	25	296	5	79.22	153.91	2.60
St Clair	159,587	21,756	63	619	31	289.58	387.88	19.43
St Joseph	60,853	8,522	11	80	1	129.08	131.46	1.64
Sanilac	41,409	5,168	8	38	1	80.58	55.43	1.46
Schoolcraft	8,001	848	0	0	0	0.00	0.00	0.00
Shiawassee	68,554	9,928	7	112	2	82.14	184.05	3.29
Tuscola	53,338	7,138	12	68	0	168.11	127.49	0.00
Van Buren	75,223	9,987	13	147	1	130.17	195.42	1.33
Washtenaw	364,709	97,705	38	624	35	38.89	171.10	9.60
Wayne	1,076,537	160,566	186	4,070	131	115.84	378.06	12.17
Wexford	33,163	4,365	7	91	0	160.37	274.40	0.00
MDOC	41,122	11,189	214	-	-	1,912.59	-	-
State-wide†	9,928,300	1,634,196	1,984	24,995	732	121.41	251.76	7.37

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

Appendix B1: Hepatitis Data by Local Health Jurisdiction

Local Health Jurisdiction	Total Population	2017 Chronic HCV Cases	2017 Acute HCV Cases	2017 Chronic HBV Cases	2017 Acute HBV Cases	2017 Chronic HCV Rate*	2017 Acute HCV Rate*	2017 Chronic HBV Rate*	2017 Acute HBV Rate*
Allegan	115,548	77	0	4	1	66.64	0.00	3.46	0.87
Barry-Eaton	168,862	151	1	10	0	89.42	0.59	5.92	0.00
Bay	104,747	118	6	3	0	112.65	5.73	2.86	0.00
Benzie-Leelanau	39,337	26	0	3	0	66.10	0.00	7.63	0.00
Berrien	154,010	151	5	6	0	98.05	3.25	3.90	0.00
Branch-Hillsdale-St. Joseph	150,054	152	0	5	1	101.30	0.00	3.33	0.67
Calhoun	134,386	182	4	14	2	135.43	2.98	10.42	1.49
Central Michigan	188,694	188	3	9	2	99.63	1.59	4.77	1.06
Chippewa	37,724	42	2	0	0	111.33	5.30	0.00	0.00
Delta-Menominee	59,483	91	6	5	0	152.98	10.09	8.41	0.00
Detroit City	672,829	1,940	8	237	11	288.33	1.19	35.22	1.63
Dickinson-Iron	36,730	73	5	1	0	198.75	13.61	2.72	0.00
District Health Department #10	261,203	248	4	7	1	94.95	1.53	2.68	0.38
District Health Department #2	64,847	95	2	9	3	146.50	3.08	13.88	4.63
District Health Department #4	76,040	72	2	0	0	94.69	2.63	0.00	0.00
Genesee	408,615	647	9	38	4	158.34	2.20	9.30	0.98
Grand Traverse	92,084	65	6	5	1	70.59	6.52	5.43	1.09
Huron	31,481	23	1	1	0	73.06	3.18	3.18	0.00
Ingham	288,051	351	9	45	1	121.85	3.12	15.62	0.35
Ionia	64,232	49	5	2	0	76.29	7.78	3.11	0.00
Jackson	158,460	162	4	6	0	102.23	2.52	3.79	0.00
Kalamazoo	261,654	259	1	19	1	98.99	0.38	7.26	0.38
Kent	642,173	564	9	106	0	87.83	1.40	16.51	0.00
Lapeer	88,340	82	0	3	1	92.82	0.00	3.40	1.13
Lenawee	98,504	81	2	1	0	82.23	2.03	1.02	0.00
Livingston	188,624	117	1	10	3	62.03	0.53	5.30	1.59
Luce-Mackinac-Alger-Schoolcraft	34,398	44	2	3	1	127.91	5.81	8.72	2.91
Macomb	867,730	896	49	108	5	103.26	5.65	12.45	0.58
Marquette	66,435	85	5	2	0	127.94	7.53	3.01	0.00
Midland	83,462	65	1	4	0	77.88	1.20	4.79	0.00
Mid-Michigan	182,064	104	1	5	1	57.12	0.55	2.75	0.55
Monroe	149,208	253	4	8	1	169.56	2.68	5.36	0.67
Muskegon	173,408	264	12	8	2	152.24	6.92	4.61	1.15
Northwest Michigan	106,970	91	3	2	2	85.07	2.80	1.87	1.87
Oakland	1,243,970	1,010	9	176	3	81.19	0.72	14.15	0.24
Ottawa	282,250	129	2	19	0	45.70	0.71	6.73	0.00
Saginaw	192,326	190	0	16	1	98.79	0.00	8.32	0.52
Sanilac	41,409	35	2	1	0	84.52	4.83	2.41	0.00
Shiawassee	68,554	46	0	4	1	67.10	0.00	5.83	1.46
St Clair	159,587	270	16	16	2	169.19	10.03	10.03	1.25
Tuscola	53,338	45	1	9	0	84.37	1.87	16.87	0.00
Van Buren-Cass	126,822	161	2	2	0	126.95	1.58	1.58	0.00
Washtenaw	364,709	219	5	62	1	60.05	1.37	17.00	0.27
Wayne	1,076,537	1,360	20	217	11	126.33	1.86	20.16	1.02
Western Upper Peninsula	68,411	80	2	3	0	116.94	2.92	4.39	0.00
MDOC	41,122	703	3	22	1	1,709.55	7.30	53.50	2.43
Statewide†	9,928,300	12,062	234	1,237	64	121.49	2.36	12.46	0.64

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

Appendix B2: Heroin Data by Local Health Jurisdiction

Local Health Jurisdiction	Total Population	Young Adult (18-29) Population	2017 Young Adult (18-29) HCV Cases	2017 Heroin Treatment Admissions	2016 Heroin Overdose Deaths	2017 Young Adult (18-29) HCV Rate*	2017 Heroin Treatment Admission Rate*	2016 Heroin Overdose Death Rate*
Allegan	115,548	15,677	14	29	4	89.30	25.10	3.46
Barry-Eaton	168,862	24,597	21	186	11	85.38	110.15	6.51
Bay	104,747	14,805	33	303	5	222.90	289.27	4.77
Benzie-Leelanau	39,337	4,275	4	33	0	93.57	83.89	0.00
Berrien	154,010	21,955	23	461	14	104.76	299.33	9.09
Branch-Hillsdale-St. Joseph	150,054	21,250	31	182	4	145.88	121.29	2.67
Calhoun	134,386	20,392	34	440	16	166.73	327.42	11.91
Central Michigan	188,694	39,109	46	263	8	117.62	139.38	4.24
Chippewa	37,724	6,994	10	8	0	142.98	21.21	0.00
Delta-Menominee	59,483	6,920	28	31	1	404.62	52.12	1.68
Detroit City	672,829	129,856	124	3,873	104	95.49	575.63	15.46
Dickinson-Iron	36,730	4,144	20	46	4	482.63	125.24	10.89
District Health Department #10	261,203	38,522	49	429	4	127.20	164.24	1.53
District Health Department #2	64,847	6,903	20	92	1	289.73	141.87	1.54
District Health Department #4	76,040	8,407	15	83	1	178.42	109.15	1.32
Genesee	408,615	61,554	116	1,516	47	188.45	371.01	11.50
Grand Traverse	92,084	13,059	12	163	1	91.89	177.01	1.09
Huron	31,481	3,648	5	37	2	137.06	117.53	6.35
Ingham	288,051	79,177	64	870	21	80.83	302.03	7.29
Ionia	64,232	10,396	6	61	3	57.71	94.97	4.67
Jackson	158,460	24,437	48	456	2	196.42	287.77	1.26
Kalamazoo	261,654	59,702	45	477	20	75.37	182.30	7.64
Kent	642,173	114,705	67	305	25	58.41	47.49	3.89
Lapeer	88,340	11,946	14	141	4	117.19	159.61	4.53
Lenawee	98,504	14,844	13	223	7	87.58	226.39	7.11
Livingston	188,624	25,247	21	115	11	83.18	60.97	5.83
Luce-Mackinac-Alger-Schoolcraft	34,398	4,002	6	10	0	149.93	29.07	0.00
Macomb	867,730	131,735	154	4,331	133	116.90	499.12	15.33
Marquette	66,435	13,918	24	37	0	172.44	55.69	0.00
Midland	83,462	12,328	15	158	3	121.67	189.31	3.59
Mid-Michigan	182,064	27,454	24	210	7	87.42	115.34	3.84
Monroe	149,208	20,856	51	561	15	244.53	375.99	10.05
Muskegon	173,408	26,163	54	777	14	206.40	448.08	8.07
Northwest Michigan	106,970	13,242	18	155	0	135.93	144.90	0.00
Oakland	1,243,970	182,782	132	1,588	21	72.22	127.66	1.69
Ottawa	282,250	55,001	20	293	9	36.36	103.81	3.19
Saginaw	192,326	31,559	25	296	5	79.22	153.91	2.60
Sanilac	41,409	5,168	8	38	1	154.80	91.77	2.41
Shiawassee	68,554	9,928	7	112	2	70.51	163.37	2.92
St Clair	159,587	21,756	63	619	31	289.58	387.88	19.43
Tuscola	53,338	7,138	12	68	0	168.11	127.49	0.00
Van Buren-Cass	126,822	16,637	18	199	1	108.19	156.91	0.79
Washtenaw	364,709	97,705	38	624	35	38.89	171.10	9.60
Wayne	1,076,537	160,566	186	4,070	131	115.84	378.06	12.17
Western Upper Peninsula	68,411	13,737	31	25	0	225.67	36.54	0.00
MDOC	41,122	11,189	214	-	-	1,912.59	-	-
Statewide†	9,928,300	1,634,196	1,984	24,995	732	121.41	251.76	7.37

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

Appendix C1: Hepatitis Data by Region

Region	Total Population	2017 Chronic HCV Cases	2017 Acute HCV Cases	2017 Chronic HBV Cases	2017 Acute HBV Cases	2017 Chronic HCV Rate*	2017 Acute HCV Rate*	2017 Chronic HBV Rate*	2017 Acute HBV Rate*
1	1,076,217	958	18	80	7	89.02	1.67	7.43	0.65
3	1,108,809	1,351	22	87	10	121.84	1.98	7.85	0.90
5	956,402	974	12	51	4	101.84	1.25	5.33	0.42
6	1,507,345	1,319	32	146	4	87.50	2.12	9.69	0.27
7	441,776	388	14	12	3	87.83	3.17	2.72	0.68
8	303,181	415	22	14	1	136.88	7.26	4.62	0.33
2N	2,271,287	2,176	74	300	10	95.80	3.26	13.21	0.44
2S	2,263,283	3,772	37	524	24	166.66	1.63	23.15	1.06
MDOC	41,122	703	3	22	1	1,709.55	7.30	53.50	2.43
Statewide†	9,928,300	12,062	234	1,237	64	121.49	2.36	12.46	0.64

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts

Appendix C2: Heroin Data by Region

Region	Total Population	Young Adult (18-29) Population	2017 Young Adult (18-29) HCV Cases	2017 Heroin Treatment Admissions	2016 Heroin Overdose Deaths	2017 Young Adult (18-29) HCV Rate*	2017 Heroin Treatment Admission Rate*	2016 Heroin Overdose Death Rate*
1	1,076,217	195,753	192	2,057	59	98.08	191.13	5.48
3	1,108,809	159,573	259	2,712	70	162.31	244.59	6.31
5	956,402	156,685	158	1,794	58	100.84	187.58	6.06
6	1,507,345	272,998	215	1,915	62	78.76	127.04	4.11
7	441,776	54,216	78	693	4	143.87	156.87	0.91
8	303,181	49,715	119	157	5	239.36	51.78	1.65
2N	2,271,287	336,273	349	6,538	185	103.78	287.85	8.15
2S	2,263,283	408,983	399	9,128	285	97.56	403.31	12.59
MDOC	41,122	11,189	214	-	-	1,912.59	-	-
Statewide†	9,928,300	1,634,196	1,984	24,995	732	121.41	251.76	7.37

*Rates are calculated per 100,000 persons in the population

†Due to cases without a defined jurisdiction, state-wide totals may include cases that were not included in jurisdiction counts