Michigan Department of Health & Human Services

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2016 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, 2016

Variable	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	46	100%	1,284	100%	154	100%	11,883	100%	9,922,576	100%
Sex										
Male	24	52%	745	58%	86	56%	6,946	58%	4,877,067	49%
Female	22	48%	538	42%	68	44%	4,906	41%	5,045,509	51%
Unknown	0	0%	1	0%	0	0%	31	0%	0	0%
Race and Ethnicity										
Caucasian	33	72%	361	28%	126	82%	5,492	46%	7,801,483	79%
Black or African American	8	17%	312	24%	13	8%	2,119	18%	1,378,111	14%
Hispanic	1	2%	24	2%	1	1%	213	2%	n/a*	-
Asian	1	2%	242	19%	1	1%	51	0%	293,157	3%
American Indian or Alaskan Native	0	0%	2	0%	1	1%	69	1%	53,668	1%
Other	0	0%	63	5%	3	2%	175	1%	392,400**	4%
Unknown	3	7%	280	22%	9	6%	3,764	32%	3,757	0%
Age										
Mean	47	-	46	-	37	-	49	-	n/a*	-
Median	46	-	46	-	33	-	53	-	40	-
Range	22-82	-	0-94	-	0-80	-	0-100	-	n/a*	-
0-19 years	0	0%	54	4%	4	3%	149	1%	2,480,644	25%
20-29 years	8	17%	150	12%	55	36%	1,848	16%	1,339,548	14%
30-39 years	8	17%	268	21%	43	28%	2,065	17%	1,170,864	12%
40-49 years	11	24%	250	19%	26	17%	1,292	11%	1,250,245	13%
50-59 years	9	20%	268	21%	13	8%	2,607	22%	1,458,619	15%
60+ years	10	22%	294	23%	13	8%	3,911	33%	2,222,657	22%
Unknown	0	0%	0	0%	0	0%	11	0%	0	0%

* Data not available in 2015 census estimates

** Includes 2015 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 2016. 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 over 82% of cases reported. 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 2016. 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 46 cases of acute hepatitis B infection reported in Michigan in 2016 for a rate of 0.46 cases per 100,000 people. This is below the most recent national rate of acute HBV infection (0.96 per 100,000).
- The rate of acute hepatitis B infection has decreased in Michigan nearly every year since 2008, likely a sign of successful vaccination programs.
- Case follow-up and completion of epidemiological risk factors was completed for 98% of acute hepatitis B cases in 2016.
- There was no risk factor that was predominantly shared between 2016 acute hepatitis B cases.

Chronic Hepatitis B

- There were 1,284 new chronic hepatitis B diagnoses reported in Michigan in 2016 for a rate of 12.93 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 82.79 per 100,000, compared to the state average of 12.94.

Acute Hepatitis C

- There were 154 cases of acute hepatitis C reported in Michigan in 2016 for a rate of 1.55 cases per 100,000 people. This is higher than rates reported from Michigan in 2015 (0.85) and the national acute HCV rate of 0.76 cases per 100,000 reported in 2015.
- 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 2016.
    - Where data were available, injection drug use was reported by 64% of acute hepatitis C cases.

Chronic Hepatitis C

- There were 11,883 new chronic hepatitis C diagnoses reported in Michigan in 2016 for a rate of 119.76 cases per 100,000 people.
- The rate of chronic hepatitis C is higher in Michigan males (142.42 per 100,000) versus females (97.23 per 100,000).
- American Indians and Alaskan Natives (149.82 per 100,000) and African Americans (155.46 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 69% of chronic hepatitis C cases in 2016.
    - 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, 76% of chronic hepatitis C cases were reported with genotype 1 infection, 15% with genotype 3, and 8% with genotype 2.

Special Populations

Hepatitis C in Young Adults

- From 2005 through 2016, the number of cases of chronic hepatitis C among persons aged 18 -29 years has increased over 473% from 359 cases to 2,060.
- 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 84.2% of hepatitis C patients.
    - Between 2000 and 2016 there has been a 187% increase in Michigan heroin substance abuse treatment admissions.
    - From 2000 through 2015 heroin overdose deaths in Michigan have increased by 624%
- The opioid epidemic is impacted both young males and females. Asa a result we have seen 20 cases of perinatal hepatitis C as a result of mother-to-child transmission over the last 5 years.

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

- From 2004-2016, there were 852 persons in Michigan reported with Hepatitis B/HIV co-infection.
    - 87.9% 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 57.6%
- From 2004-2016, there were 1,246 persons in Michigan reported with Hepatitis C/HIV co-infection.
    - 71.4% of these persons are male.
    - The primary modes of HIV transmission in the HIV/HCV co-infection group were IDU at 43.0% and MSM at 19.8%
- Incidence of HBV/HIV co-infections and HIV/HCV co-infection 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.

Viral Hepatitis Outcomes

Hospitalization Data

- Hospitalizations attributed to hepatitis C increased by nearly 40% from 2005 through 2014, 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 33.3% between 2004 and 2013.
- The liver cancer rate among African American males (18.8 cases per 100,000) is more than twice that among Caucasian males (7.9 cases per 100,000).
- The overall liver cancer mortality has increased by 39.3% between 2004 and 2014 in Michigan.
- In 2014, the Michigan liver cancer mortality rate was over twice as high in African-American males(8.9 per 100,000) as it was in Caucasian males (4.4 per 100,000).
- Among persons with a positive HCV antibody test, only 11.6% have been treated, according to Medicaid data.

Viral Hepatitis-Related Mortality

- There were 174 deaths attributed to chronic hepatitis C in Michigan in 2015.
- Deaths due to chronic hepatitis C alone increased by 65.7% between 2005 and 2015.

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 highlight acute, chronic, and perinatal hepatitis B and C surveillance. 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 is caused by a group of viruses that infect the liver. The most common types of viral hepatitis are hepatitis A, hepatitis B, and hepatitis C. 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. Hepatitis A is transmitted from person to person via ingestion of food and water contaminated with human waste while hepatitis B and C are both blood borne pathogens. Many persons infected with hepatitis B or hepatitis C are unaware they are infected. Unlike hepatitis A, both hepatitis B and hepatitis C viruses 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 B

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 hepatitis B infection and about 600,000 people die every year due to the acute or chronic consequences of hepatitis B.

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

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 hepatitis C is by avoiding behaviors that can spread the disease, especially sharing injection drug use works.

The incubation period for hepatitis C 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 hepatitis C virus 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 hepatitis C-related liver diseases.

Since no vaccine is available for preventing hepatitis C 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 Hepatitis C 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 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, 2016 and December 31, 2016 in MDSS.

Local Health Jurisdiction Structure

The state of Michigan is divided into eight public health preparedness regions which are serviced by 45 health jurisdictions which are comprised of 84 county health departments. 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 2015 was used to calculate rates in 2016. 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 2016. In general, this is not necessarily reflective of the true number of new infections that occurred in 2016 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 2016. 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 hepatitis c case counts and rates between 2015 and 2016 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 hepatitis B and 15-17% of acute hepatitis C 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 hepatitis B and C 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. While we attempted to remove all MDOC cases from LHD case counts, counties that have correctional facilities within their boundaries may have a higher number of HCV cases than would be expected (e.g. Jackson County).

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.

Web Links to Case Definitions and Case Report Forms

National Notifiable Disease Surveillance System Case Definitions

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

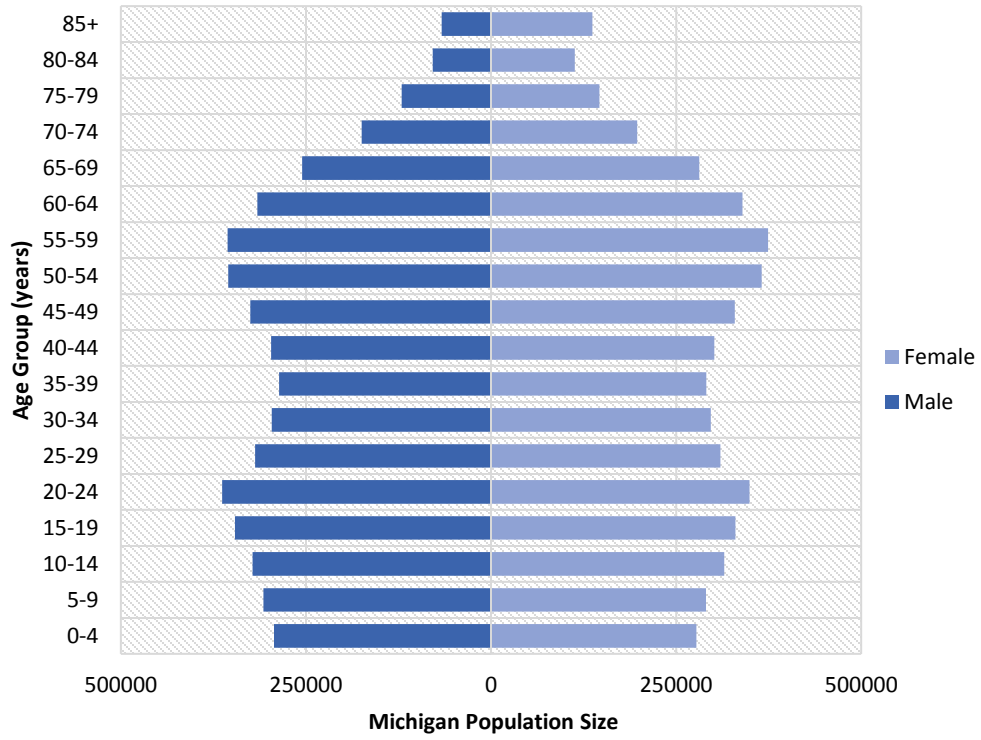
Michigan Viral Hepatitis Case Report Forms

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

Michigan Census and Demographics

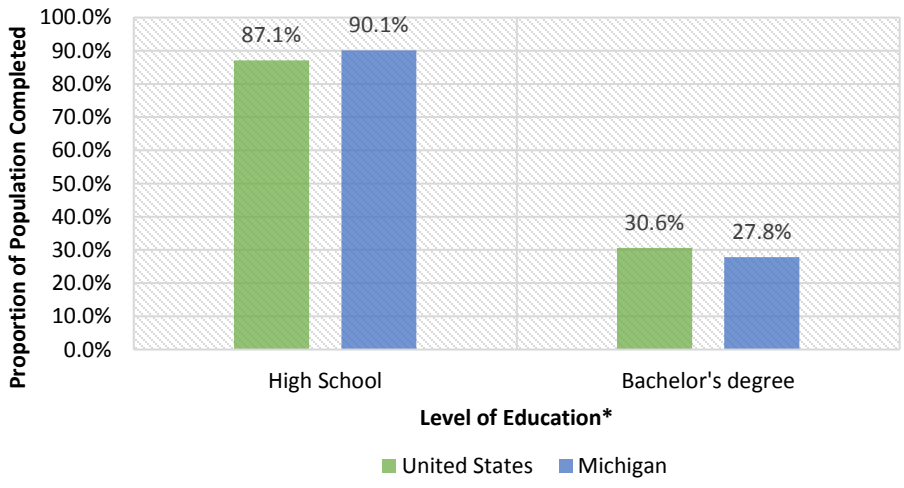
Population by Age, Gender & Education

Figure 1.1 Age and Sex: Michigan, 2015



In 2015, the Michigan population was 9,922,576; the 10th most populous state in the United States. Persons born between 1945 through 1965, amounted to 2,642,855 persons or 27 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 77% 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 thirty-nine years old.

Figure 1.2 Level of education: Michigan and the U.S., 2015



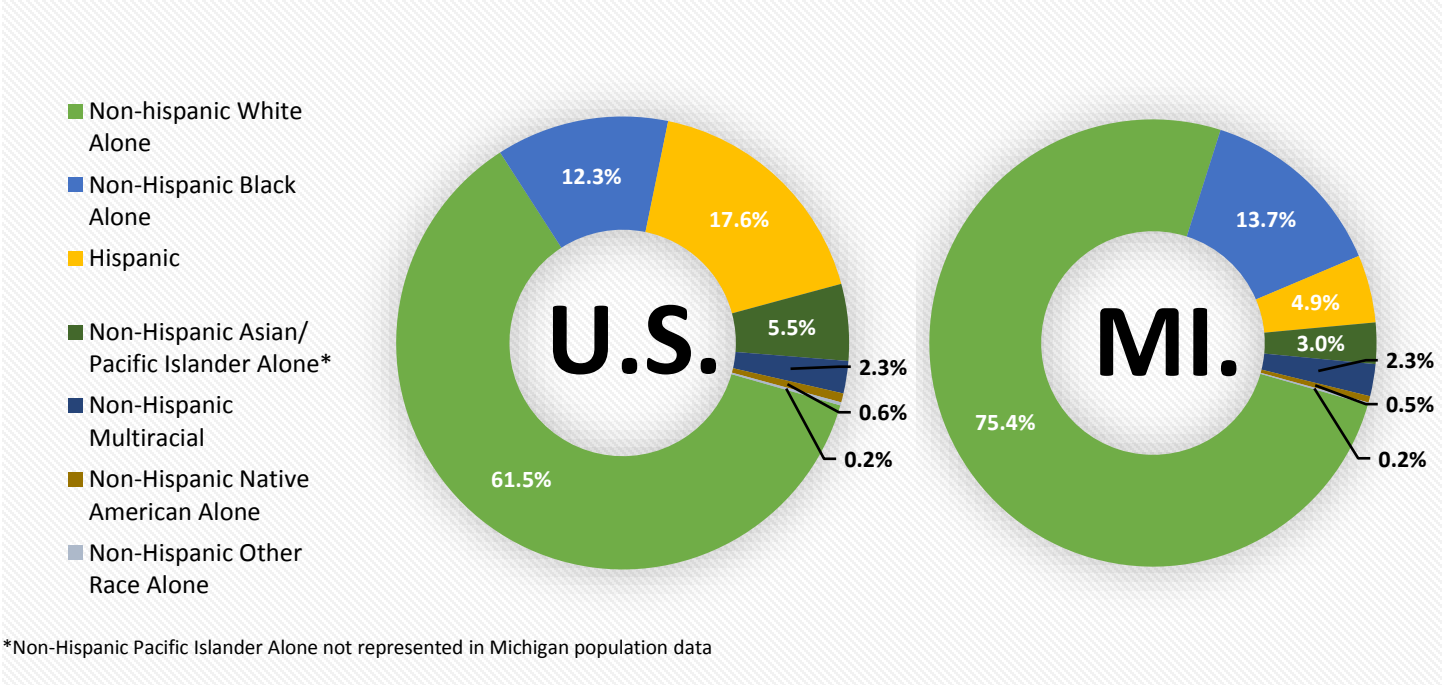
Looking at those aged twenty-five years and older, 90.1% of Michigan's population completed high school, more than the national benchmark at 87.1%. A higher percentage of the national population, however, completed a Bachelor's degree than did those from the state of Michigan.

*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 the U.S., 2015



*Non-Hispanic Pacific Islander Alone not represented in Michigan population data

According to the 2015 ACS estimates, the racial and ethnic composition of Michigan is 75.4 percent non-Hispanic white; 13.7 percent black; 4.9 percent Hispanic; 3.0 percent non-Hispanic Asian alone; 3.0 percent multiracial or other race. Nationally, the population of non-Hispanic white is 61.5 percent of the total, and the Hispanic population is 17.6 percent. The proportion of male and females within each racial/ethnic group is similar. Between 2010 and 2015, there was a 23.83% rise in Michigan's Asian/ Pacific Islander population and a 55.39% rise in Michigan individuals with some other race classification.

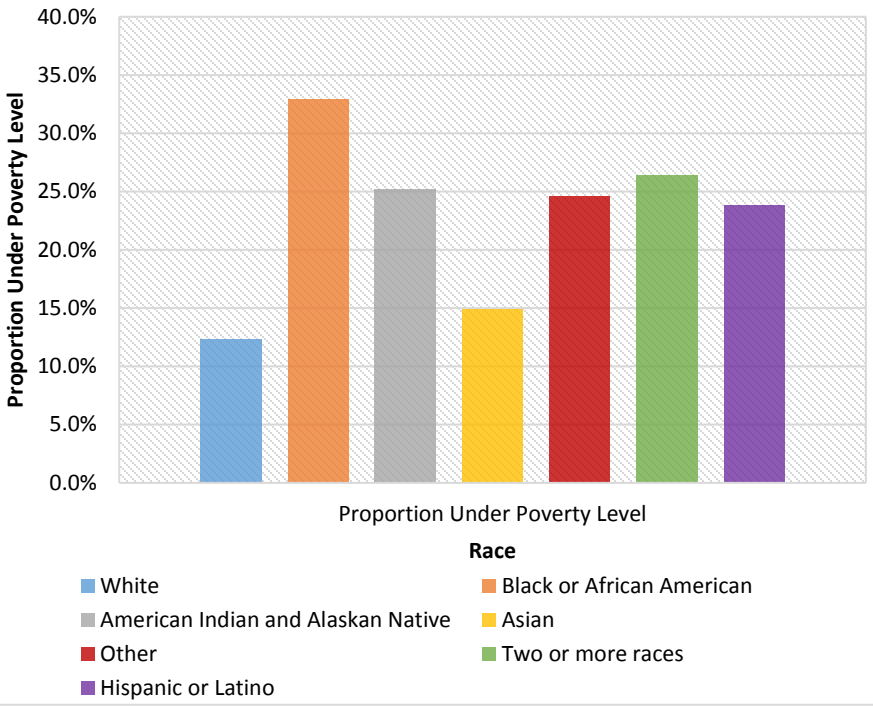
Table 1.4 Population by race: Michigan, 2010-2015

	2010 Census		2015 ACS		2010-2015	
Race	**Population Count**	**Percent of Total**	**Population Count**	**Percent of Total**	**Change**	**Percent Change**
Total Population	9,883,640	100.00%	9,922,576	100.00%	38,936	0.39%
White Alone	7,569,939	76.60%	7,486,419	75.45%	-83,520	-1.10%
Black Alone	1,383,756	14.00%	1,363,082	13.74%	-20,674	-1.49%
Hispanic	436,358	4.40%	485,972	4.90%	49,614	11.37%
Asian/ Pacific Islander Alone	238,660	2.41%	295,533	2.98%	56,873	23.83%
Multiracial	190,396	1.90%	230,183	2.32%	39,787	20.90%
Native American Alone	54,665	0.60%	46,056	0.46%	-8,609	-15.75%
Other Race Alone	9,866	0.10%	15,331	0.15%	5,465	55.39%

Source: The United States Census Bureau

Poverty, Income & Health Insurance

Figure 1.4 Population under the poverty line by race: Michigan, 2015



The poverty line is determined at a national level each year. In 2015 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 2015 (32.9%), with over 400,000 individuals in poverty. The white population had the lowest percentage of poverty (12.3%) 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 23-26%).

In 2015, about 94% of Michigan's population was covered by public or private insurance, which was slightly higher than the U.S. population as a whole (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., 2015

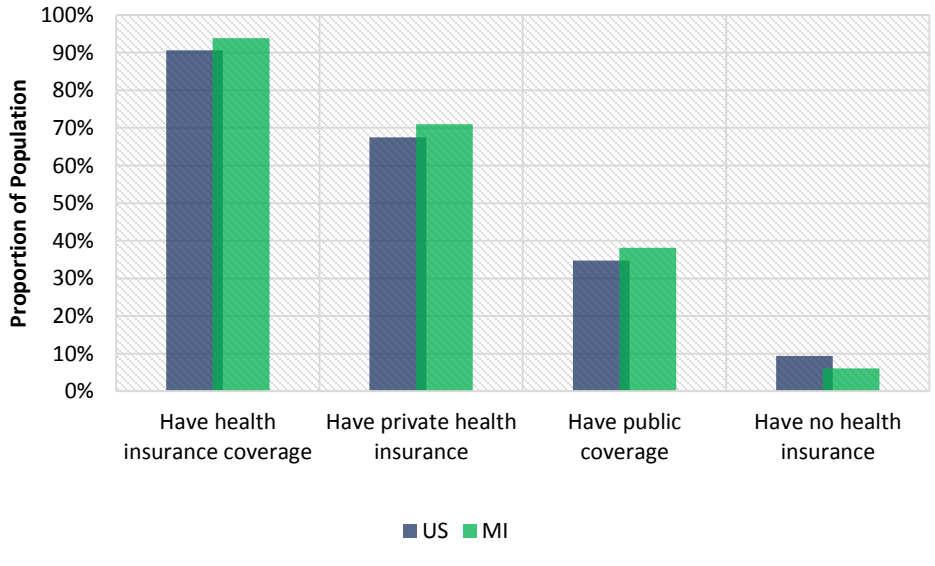
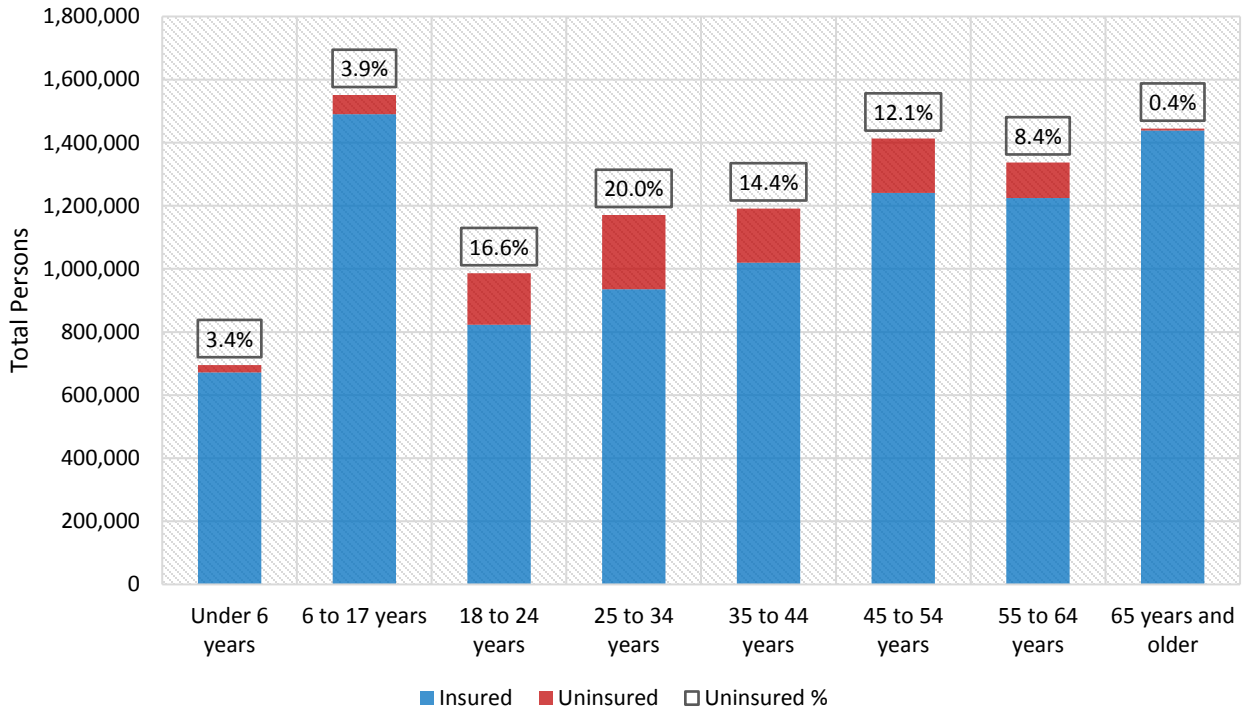
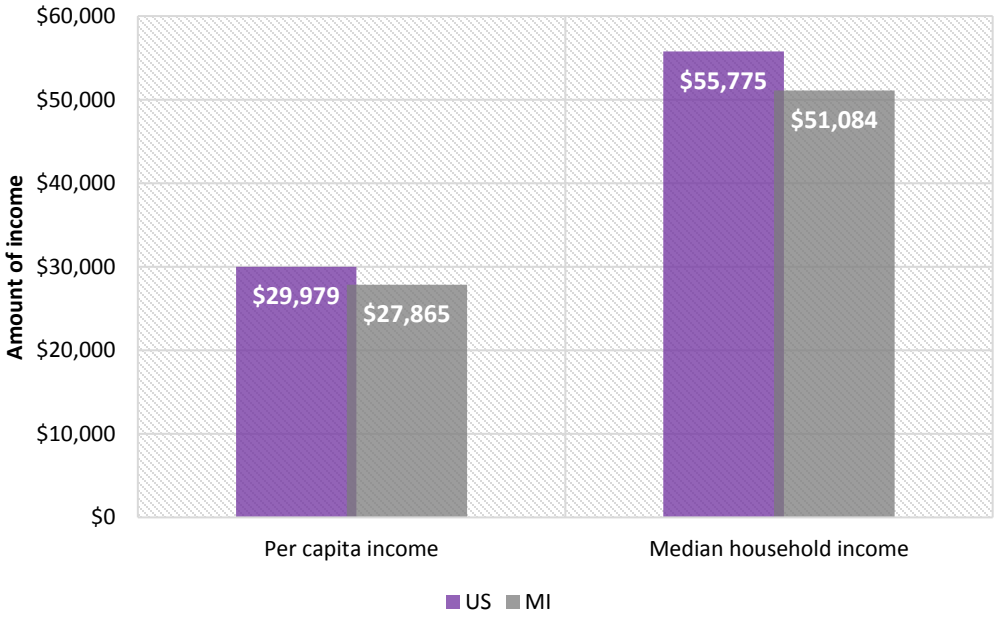


Figure 1.6 Michigan Population by Age Group, Proportion Insured, and Percent Uninsured, 2015



As estimated by the U.S. Census, the most populous age group in Michigan is aged 6 to 17 years old, with approximately 1.51 million individuals. That group, along with the under 6 and over 65 year old populations, are all estimated to have insurance coverage of 96% 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 (20.0%), followed by the 18 to 24 year old (16.6%) and 35 to 44 year old (14.4%) cohorts.

Figure 1.7 Income: Michigan and the U.S., 2015



The Michigan population had lower levels of income than that of the U.S. population. The average per capita income for Michigan ($27,865) was 7% lower than the U.S. average ($29,979), and the median household income for Michigan ($51,084) was approximately 8% below the national median ($55,775).

Acute Hepatitis B

Acute Hepatitis B—Incidence and Gender

Figure 2.1 Incidence of Acute Hepatitis B in Michigan and United States, 2012-2016

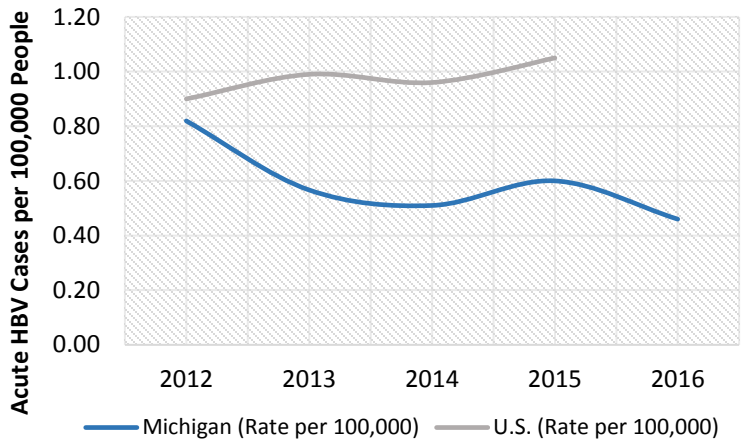


Table 2.1 Incidence of Acute Hepatitis B, Michigan and United States, 2012-2016

Year	Michigan Cases	Michigan (Rate per 100,000)	U.S. (Rate per 100,000)
2012	81	0.82	0.9
2013	56	0.57	0.99
2014	50	0.51	0.96
2015	61	0.6	1.05
2016	46	0.5	N/A

The incidence of acute hepatitis B has decreased in Michigan from 2012 through 2014, increasing only slightly in 2015, and decreasing again in 2016. Decreases in acute hepatitis B diagnoses in Michigan are likely the result of increases in hepatitis B vaccination which protect against HBV infection. With more individuals in the community protected against the virus, new infections have decreased.

Figure 2.2 Number of Acute Hepatitis B Cases by Gender in Michigan, 2012-2016

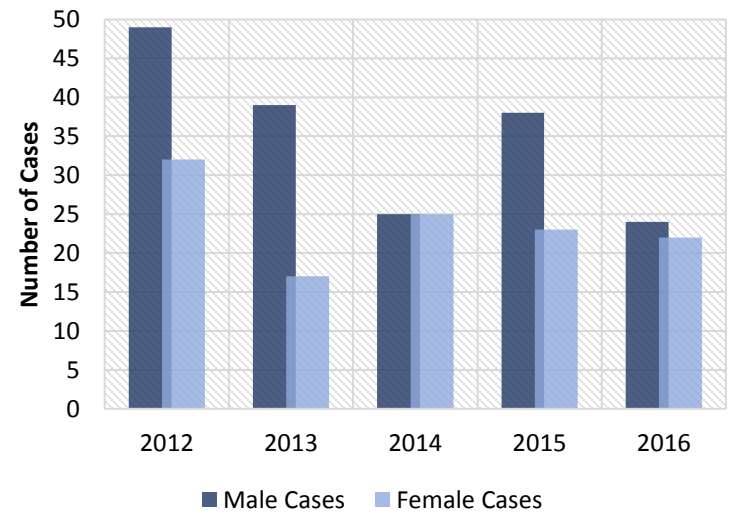


Table 2.2 Acute Hepatitis B Total Cases and Incidence Rate by Gender in Michigan, 2012-2016

Year	Male Cases	Male Incidence	Female Cases	Female Incidence
2012	49	1.01	32	0.64
2013	39	0.8	17	0.34
2014	25	0.52	25	0.5
2015	38	0.78	23	0.46
2016	24	0.49	22	0.44

Despite moderate increases in acute hepatitis B incidence for females in 2014 and males in 2015, the overall incidence from 2012 to 2016 has decreased considerably for both genders. In general, acute infections appear to be more incident in males, with the exception of 2014 when incidence was equal between sexes.

Acute Hepatitis B—Race and Ethnicity

Figure 2.3 Incidence of Acute Hepatitis B by Race in Michigan, 2012-2016

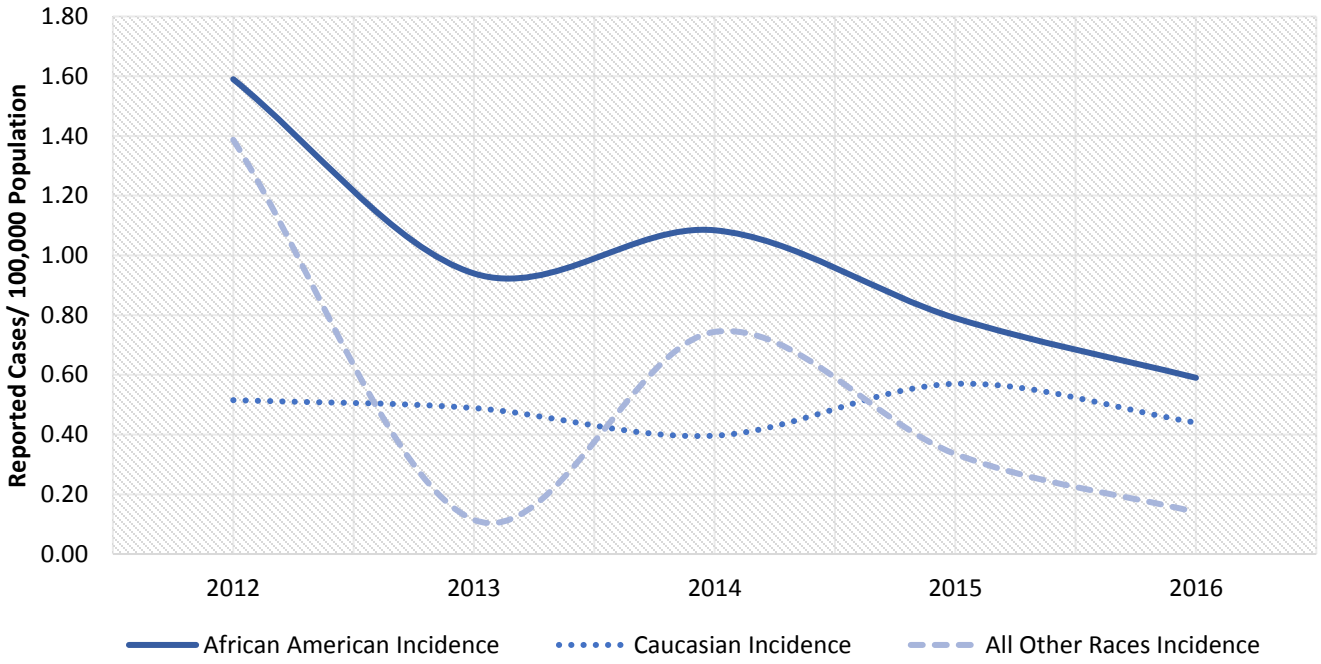


Table 2.3 Incidence of Acute Hepatitis B by Race and Ethnicity in Michigan, 2012-2016

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

In 2016, African Americans had the greatest incidence of acute hepatitis B in Michigan. Since 2012, incidence of acute hepatitis B has decreased in every racial and ethnic group by at least two-fold. Increases in the African American, American Indian/Alaskan Native, Asian and Other populations in 2014, as well as the Asian and Caucasian populations in 2015 have been documented, but rates have since decreased. In 2016, the rate of acute hepatitis B was highest for African Americans and Caucasians. The rate of acute hepatitis B was lowest for American Indian or Alaskan Natives and other races.

Acute Hepatitis B—Risk Behaviors

Table 2.4a Completeness of Acute Hepatitis B Reports by Risk Behavior in Michigan, 2016 (n = 46)

Risk Behavior	Completed
Injection Drug User	98%
Used Street Drugs	83%
Hemodialysis	96%
Received Blood Products	96%
Received a Tattoo	96%
Accidental Needle Stick	91%
Contact of Person with Hepatitis B	96%
Other Surgery	85%
Oral Surgery or Dental Work	96%
Employed in Medical Field	96%
Employed as Public Safety Officer	93%
Incarceration Longer than 6 Months	93%
Any Part of Body Pierced (other than ear)	96%

Table 2.4a shows the percentage of acute hepatitis B 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 hepatitis B epidemiologic information questions were completed for approximately 93% of case reports. This is an increase from the 70% of acute hepatitis B questions completed in the year 2012 before enhanced viral hepatitis surveillance funding and similar to case follow-up rates reported in 2015 (91%). According to the CDC, the national average for completeness of acute hepatitis B case report forms was 58% in 2014.

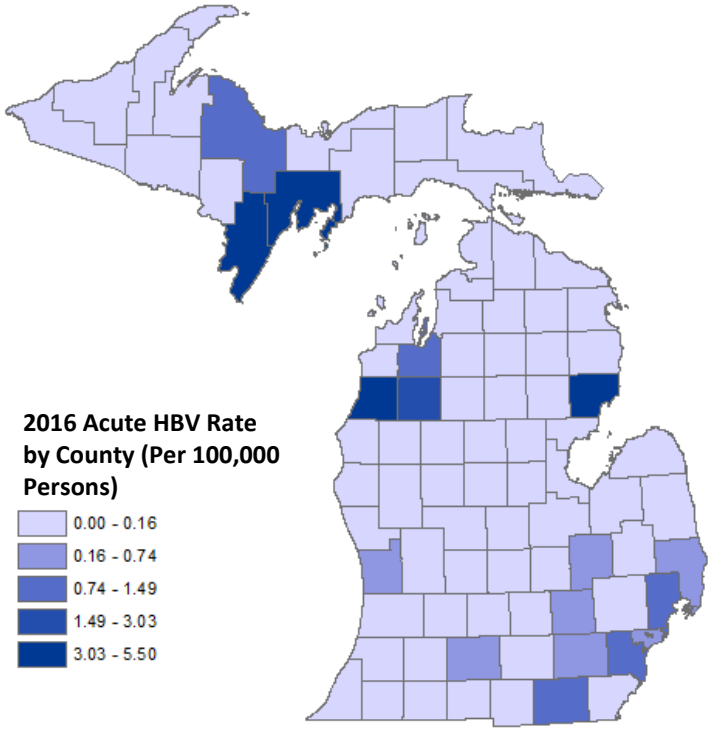
Table 2.4b Response of Completed Acute Hepatitis B Reports* by Risk Behavior in Michigan, 2016

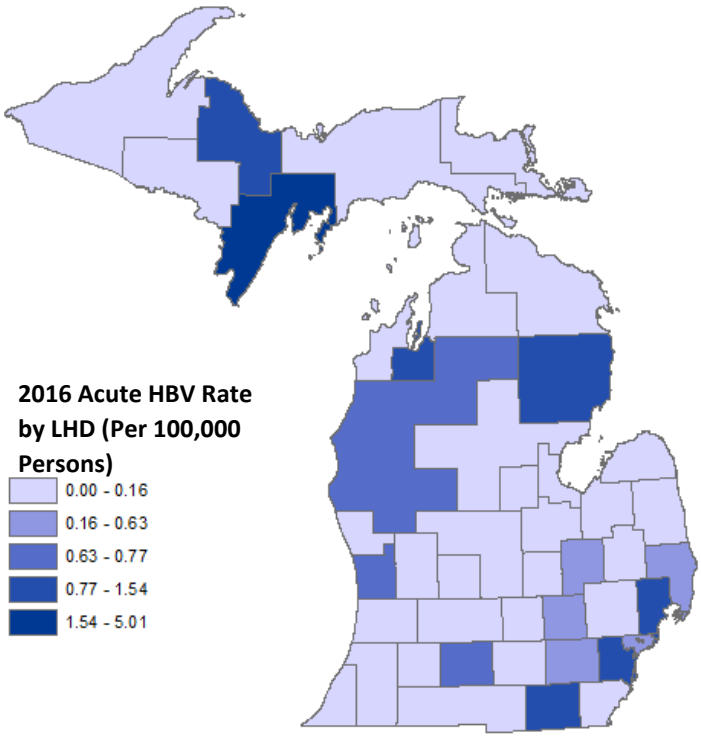
Risk Behavior	Yes*	No*	Unknown*	U.S. - 2014
Injection Drug User	9%	80%	11%	25.8%
Used Street Drugs	16%	71%	13%	
Hemodialysis	0%	86%	14%	0.2%
Received Blood Products	2%	75%	23%	0.1%
Received a Tattoo	7%	68%	25%	
Accidental Needle Stick	0%	71%	29%	4.9%
Contact of Person with Hepatitis B	2%	61%	36%	3.9%
Other Surgery	10%	67%	23%	10.8%
Oral Surgery or Dental Work	30%	43%	27%	
Employed in Medical Field	2%	80%	18%	0.3%
Employed as Public Safety Officer	0%	84%	16%	
Incarceration Longer than 6 Months	0%	74%	26%	
Any Part of Body Pierced (other than ear)	2%	73%	25%	

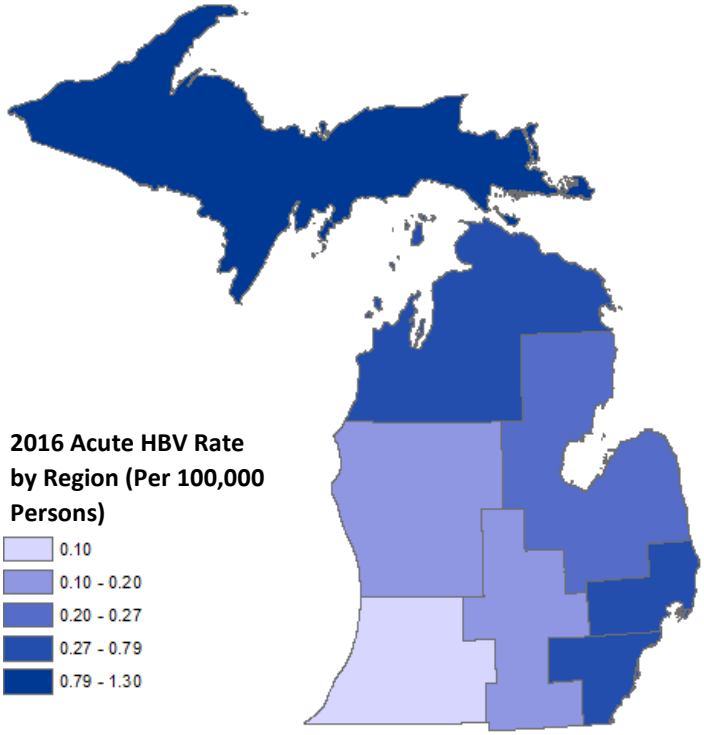
* Percentages calculated based upon those who completed the field; excludes missing data

Table 2.4b shows the hepatitis B acquisition risk factors reported by clients in the 6 weeks to 6 months prior to onset of symptoms. Oral surgery or dental work was the most common potential exposure, with 'Yes' being selected on 30% of cases with completed risk behavior questions. No 2016 acute HBV cases were receiving hemodialysis, reported an accidental needle stick, were employed as a public safety officer, or were incarcerated for longer than 6 months. In general, acute hepatitis b acquisition appears sporadic and not associated with any one particular risk factor.

Acute Hepatitis B Rate Maps by County, Local Health Jurisdiction, and Region







Chronic Hepatitis B

Chronic Hepatitis B—Incidence and Gender

Figure 3.1 Chronic Hepatitis B Cases per 100,000 Persons, Michigan, 2012-2016

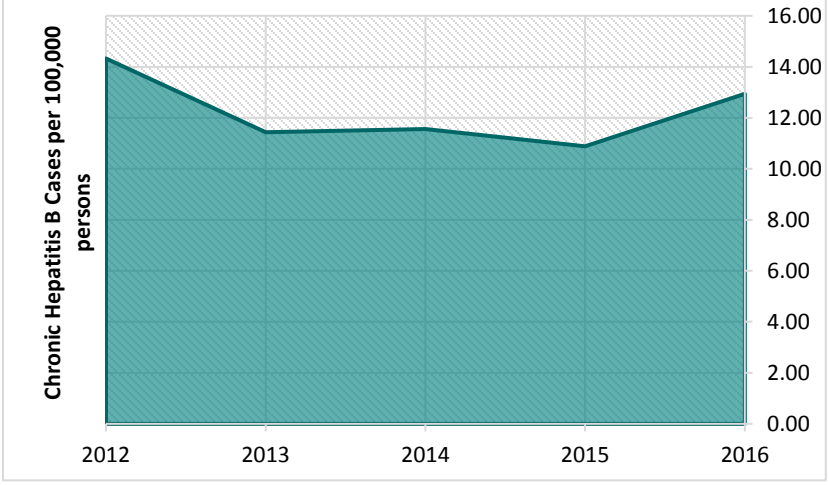


Table 3.1 Chronic Hepatitis B Cases per 100,000 Persons, Michigan, 2012-2016

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

The number of new chronic hepatitis B diagnoses decreased considerably in 2013, and again in 2015, but increased in 2016. A map of 2016 chronic hepatitis B rates by county, local health jurisdictions, and region is located on page 26. There is no national benchmark for comparing rates of chronic hepatitis B infection. Decreases in cases after 2012 maybe due, in part, to increased de-duplication efforts and removal of redundant cases MDHHS staff. Increases in the number of cases reported in 2016 may be due to improved laboratory reporting from certain Michigan health systems.

Figure 3.2 Chronic Hepatitis B Cases per 100,000 Population by Gender, Michigan, 2012-2016

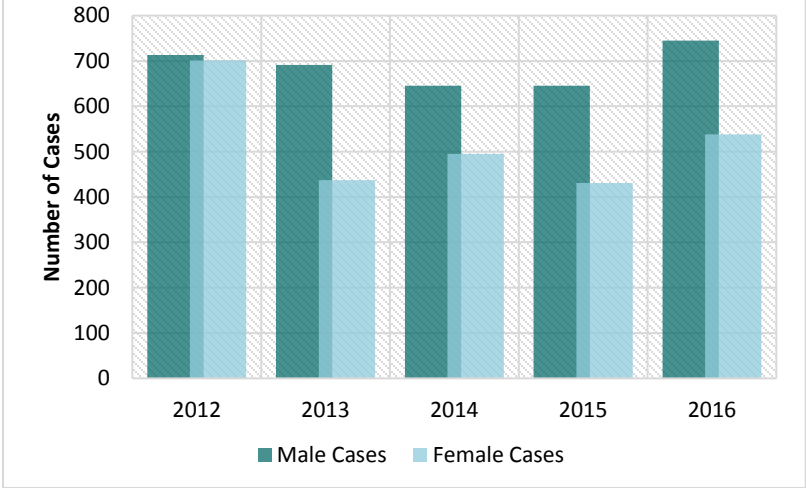


Table 3.2 Chronic Hepatitis B Cases per 100,000 Population by Gender in Michigan, 2012-2016

Year	Male	Male Incidence	Female	Female Incidence
2012	713	14.71	701	13.92
2013	691	14.25	437	8.68
2014	645	13.30	495	9.83
2015	645	13.30	431	8.56
2016	745	15.28	538	10.66

The rate of chronic hepatitis B reporting in Michigan has remained higher among males in comparison to females between the years of 2012 and 2016. The rate for males had decreased from 2012 through 2014, but remained steady in 2015 and, in 2016, increased to the highest rate (15.28) seen in the past 5 years. The rate for females peaked in 2012, with a considerable drop in cases from 2013 through 2015. That decrease is largely due to increased emphasis on the removal of duplicate chronic hepatitis B cases, particularly among women of childbearing age. In 2016 the female chronic hepatitis B incidence rate increased to its highest level since 2012, at 10.66 per 100,000.

Chronic Hepatitis B—Race and Ethnicity

Figure 3.3 Chronic Hepatitis B Cases per 100,000 by Race and Ethnicity, Michigan, 2012-2016

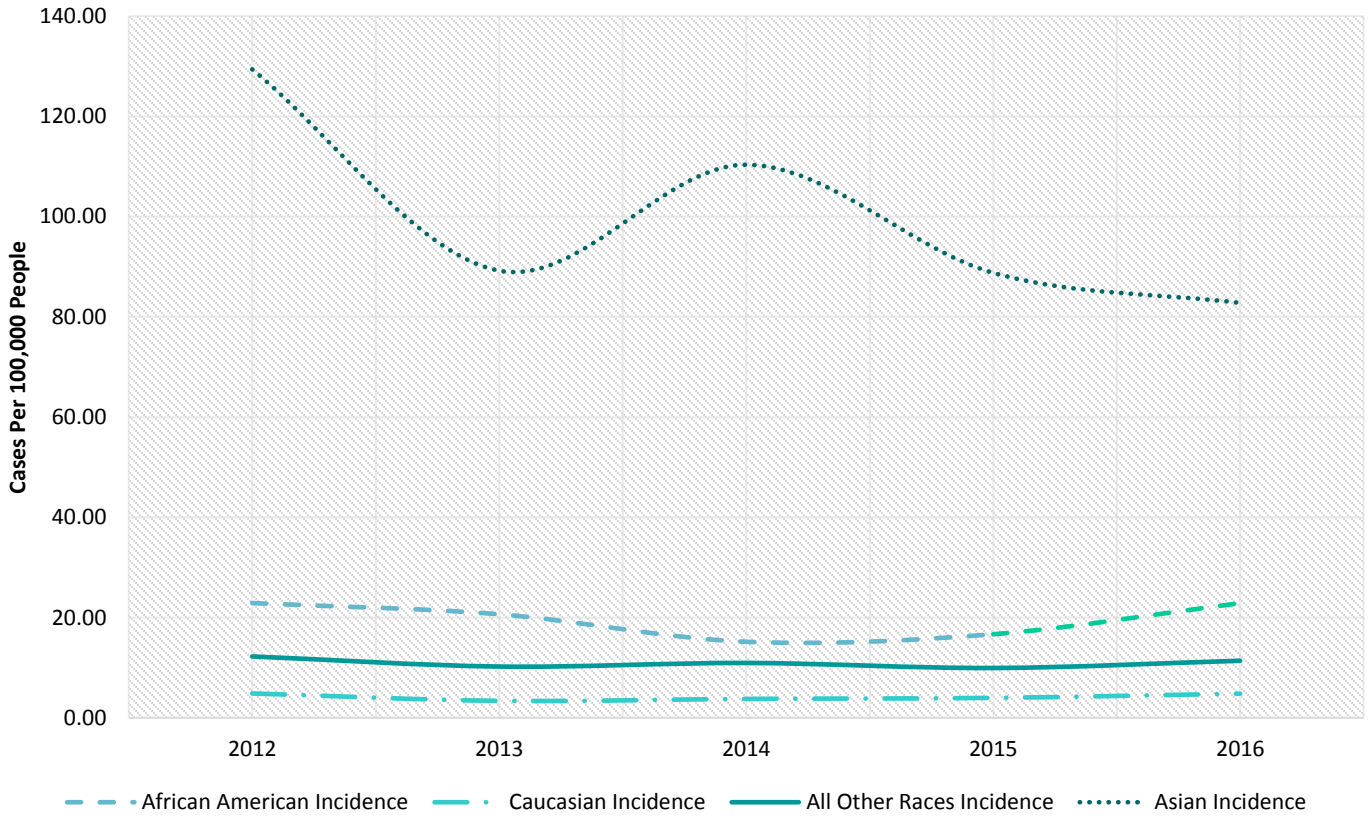


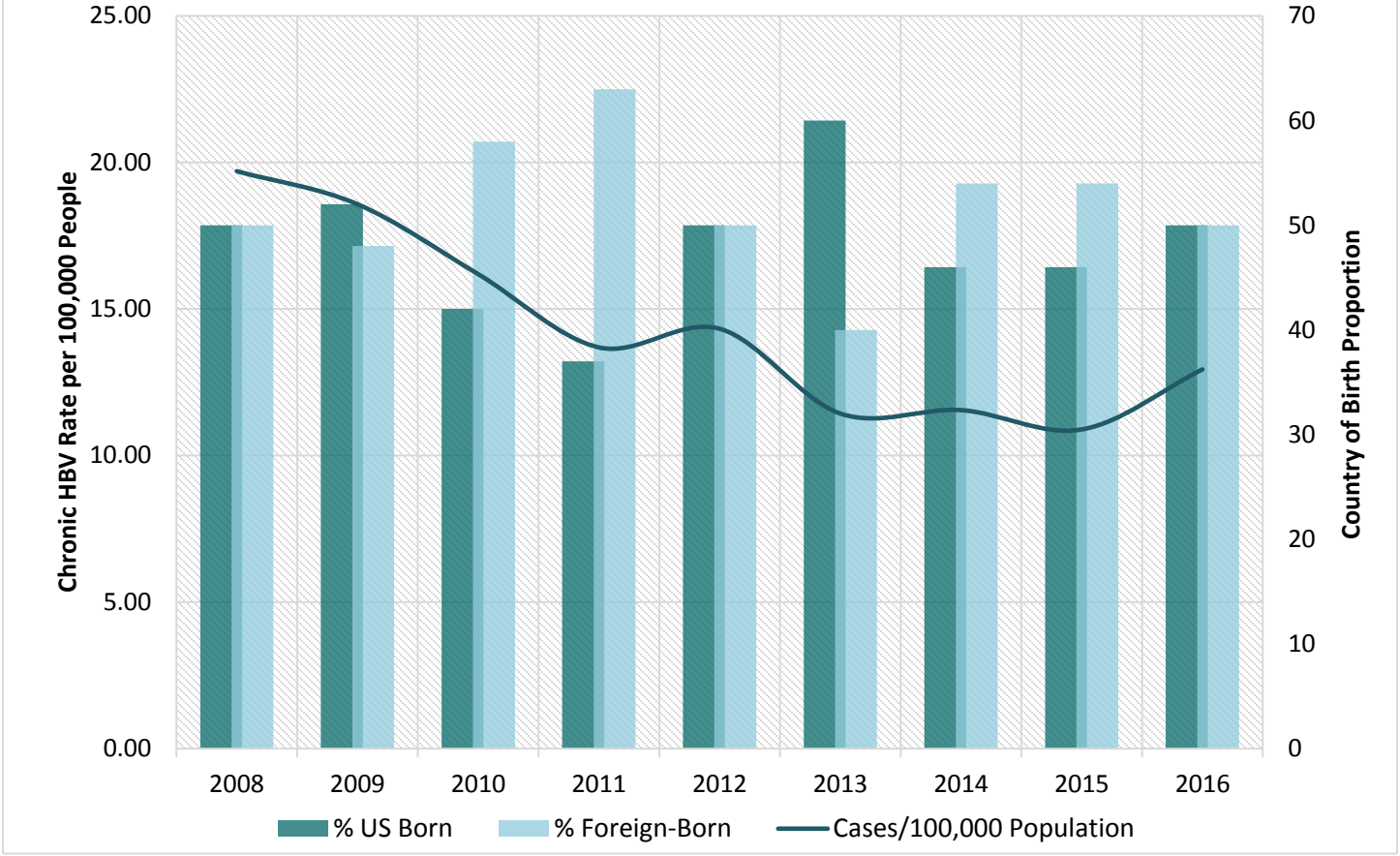
Table 3.3 Chronic Hepatitis B Cases per 100,000 by Race and Ethnicity, Michigan, 2012-2016

Year	African American	African American Incidence	American Indian	American Indian Incidence	Asian	Asian Incidence	Caucasian	Caucasian Incidence	Hispanic	Hispanic Incidence	Other	Other Incidence
2012	317	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

In 2016, Asians had the highest rate (82.79 per 100,000) of chronic hepatitis B infection in Michigan, followed by African Americans (22.89 per 100,000). The Asian infection rate of 82.79 is 17.2 times higher than the 2016 Caucasian rate (3.82 cases per 100,000). Asian-Americans are the target of CDC's K**NO**W HEPATITIS B campaign due to that disparity.

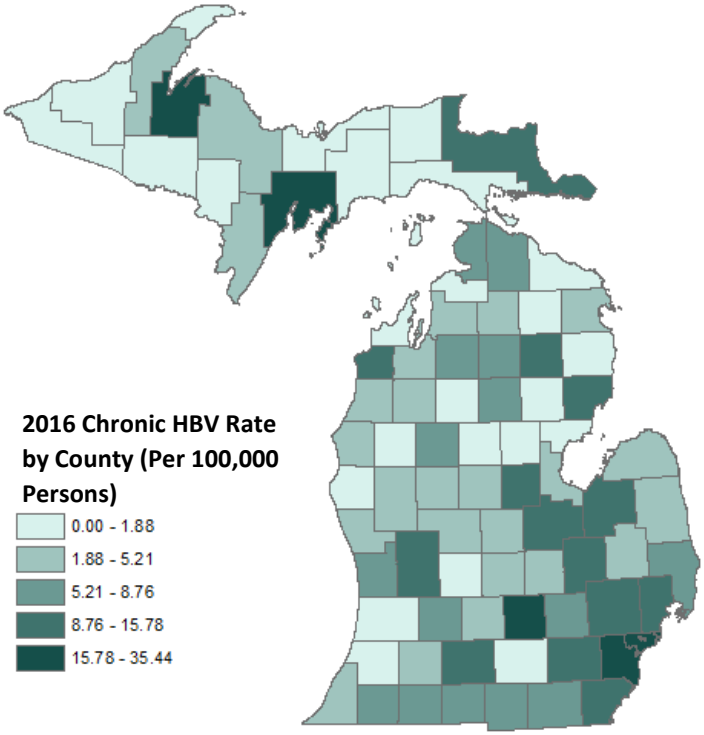
In this report we switched from using the 2010 Census to using 2015 Census estimates for calculation of infection rates. This explains why the infection rate for Asians went down even though the case count went up.

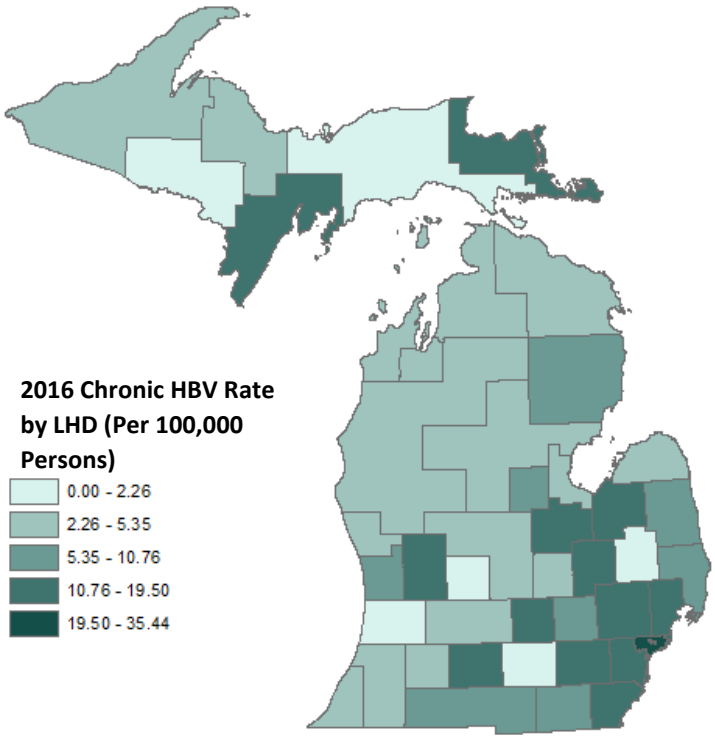
Figure 3.4 Chronic Hepatitis B Cases per 100,000 Population and Country of Birth in Michigan, 2008-2016

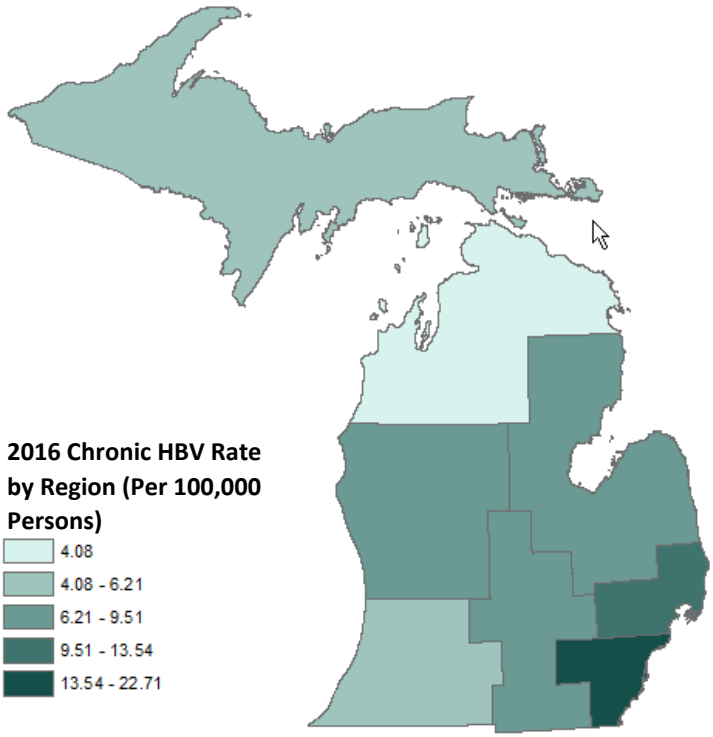


In general, the rate of chronic hepatitis B cases in Michigan has experienced a downward trend since 2008, where slight increases in 2012, 2014, and 2016 have been offset by larger decreases in other calendar years within the timeframe. When comparing the origin of birth among individuals, more people infected with hepatitis B were born outside the United States than in the United States. This is not surprising since hepatitis B is common in many countries, particularly in Asia.

Chronic Hepatitis B Rate Maps by County, Local Health Jurisdiction, and Region







Acute Hepatitis C

Acute Hepatitis C—Incidence and Gender

Figure 4.1 Incidence of Acute Hepatitis C, Michigan and U.S., 2012-2016

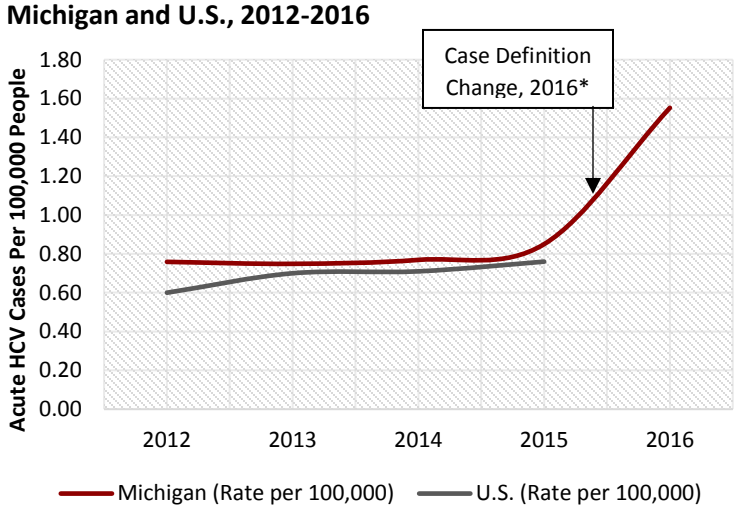


Table 4.1 Incidence of Acute Hepatitis C, Michigan and U.S., 2012-2016

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	N/A

The number of acute hepatitis C cases in Michigan stayed relatively stable from 2012 to 2014, but increased slightly in 2015 and nearly doubling in 2016. A CDC/CSTE acute HCV case definition change in January 2016 is at least partially responsible for this sharp increase. Michigan acute HCV infection rates have closely followed published national benchmarks. There are incidence maps of acute hepatitis C by county, local health jurisdiction, and region in 2016 located on page 31.

Figure 4.2 Incidence of Acute Hepatitis C by Gender, Michigan, 2012-2016

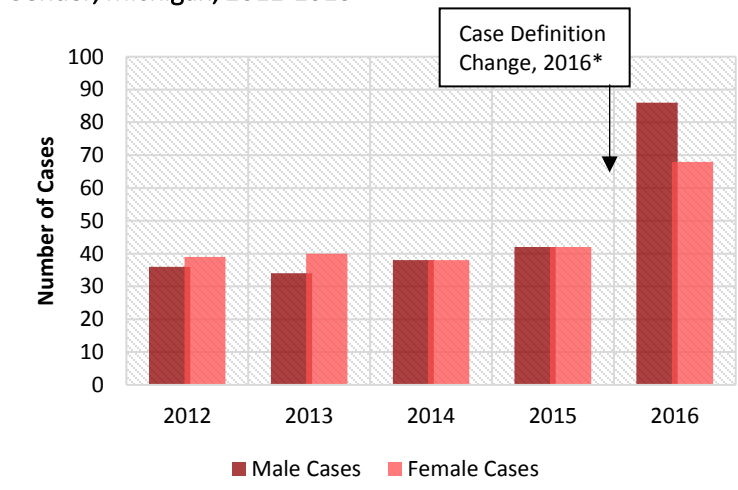


Table 4.2 Incidence of Acute Hepatitis C by Gender in Michigan, 2012-2016

Year	Male	Male Incidence	Female	Female Incidence
2012	36	0.74	39	0.77
2013	34	0.70	40	0.79
2014	38	0.78	38	0.75
2015	42	0.87	42	0.83
2016*	86	1.76	68	1.35

Since 2012 the difference in acute HCV diagnoses between males and females has been minimal, with the exception of 2016 with males having 1.3 times more acute HCV diagnoses than females. Again, increases in case counts in 2016 may be related to the change in the case counting methodology as a result of the change in case definition.

Acute Hepatitis C—Race and Ethnicity

Figure 4.3 Incidence of Acute Hepatitis C by Race and Ethnicity, Michigan, 2012-2016

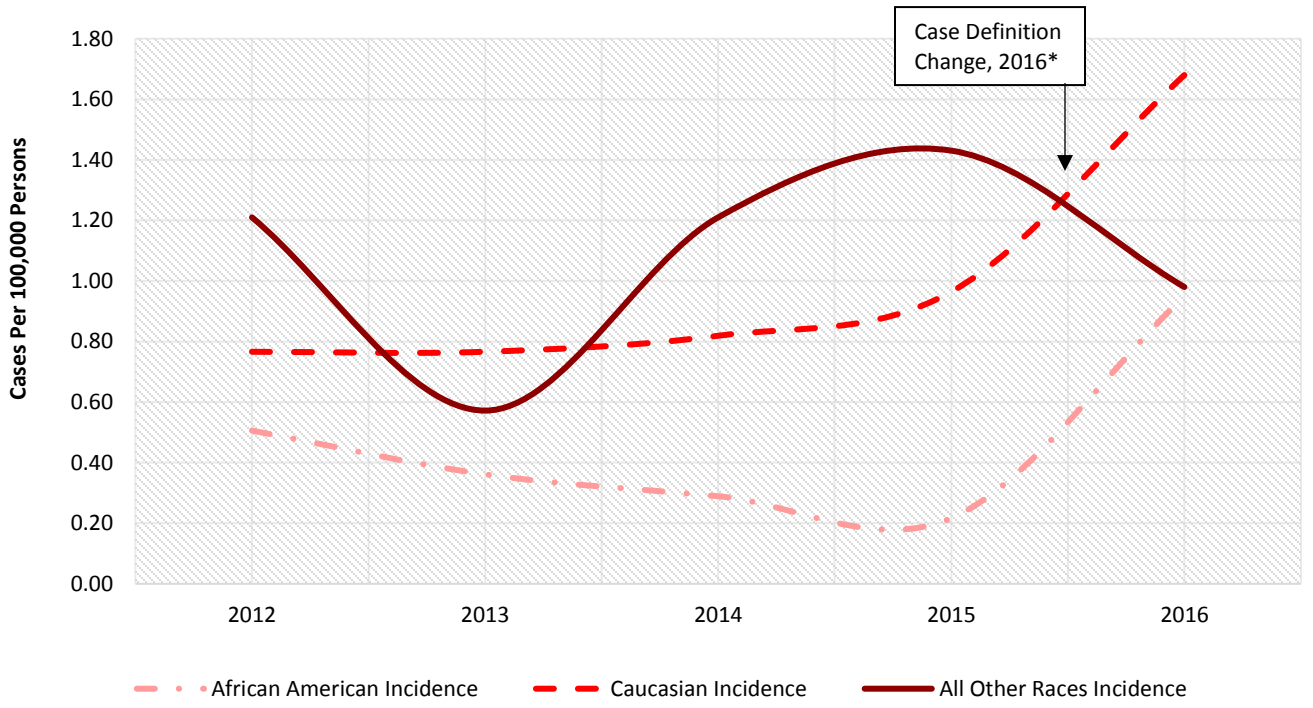


Table 4.3 Incidence of Acute Hepatitis C by Race and Ethnicity, Michigan, 2012-2016

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

Over 80% of all the acute HCV cases in 2016 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. 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 2.17 cases per 100,000. It should be noted that increases in case counts in these populations may be a result of the change in case definition in 2016.

In this report we switched from using the 2010 Census to using 2015 Census estimates for calculation of infection rates. This explains why the infection rate for Asians went down even though the case count stayed the same.

Table 4.4a Completeness of Acute Hepatitis C Reports by Risk Behavior, Michigan, 2016

Risk Behavior	Completed
Injection Drug User	96%
Used Street Drugs	94%
Hemodialysis	94%
Received Blood Products	94%
Received a Tattoo	95%
Accidental Needle Stick	91%
Contact of Person with Hepatitis C	96%
Other Surgery	89%
Oral Surgery or Dental Work	94%
Employed in Medical Field	94%
Employed as Public Safety Officer	94%
Incarceration Longer than 6 Months	94%
Any Part of Body Pierced (other than ear)	93%

Table 4.4a shows the percentage of acute hepatitis C risk behavior questions that were completed by local health department staff in 2016. A risk behavior was considered completed if the question was marked as 'Yes', 'No', or 'Unknown'. Most questions were answered with a 94% response rate. This is 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 hepatitis C case report forms was 60% in 2015.

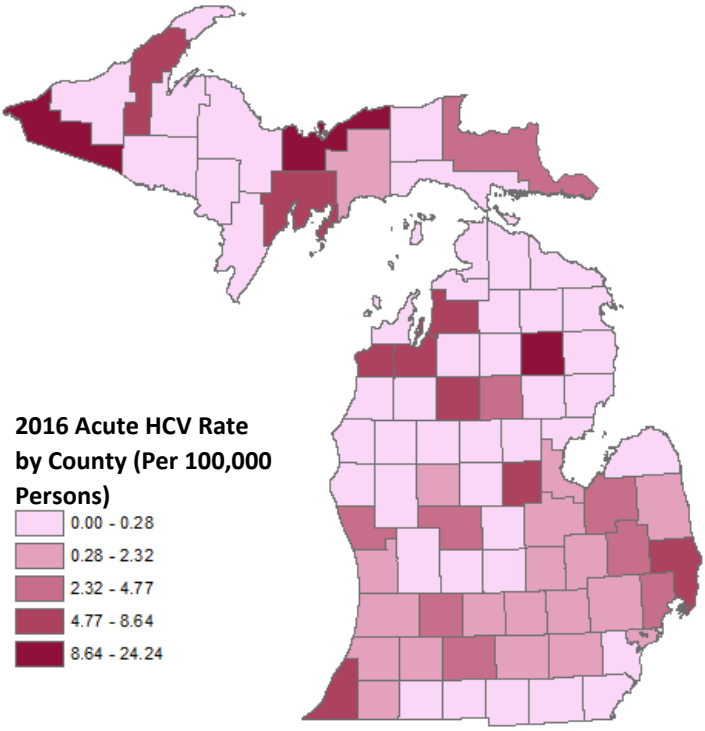
Table 4.4b Response of Completed Acute Hepatitis C Reports* by Risk Behavior, Michigan, 2016

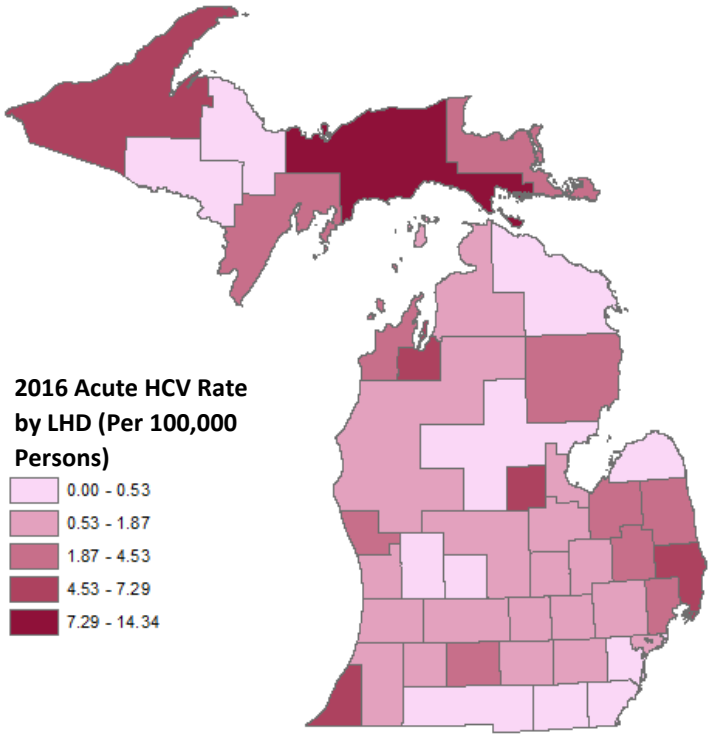
Risk Behavior	Yes*	No*	Unknown*	Yes Responses U.S. Wide 2014
Injection Drug User	57%	32%	11%	68.2%
Used Street Drugs	47%	36%	17%	-
Hemodialysis	1%	87%	13%	0.2%
Received Blood Products	5%	72%	23%	-
Received a Tattoo	36%	32%	33%	-
Accidental Needle Stick	8%	61%	31%	7.7%
Contact of Person with Hepatitis C	31%	28%	41%	-
Other Surgery	28%	47%	25%	12.2%
Oral Surgery or Dental Work	20%	45%	35%	-
Employed in Medical Field	6%	71%	24%	1.0%
Employed as Public Safety Officer	1%	76%	24%	-
Incarceration Longer than 6 Months	12%	52%	36%	-
Any Part of Body Pierced (other than ear)	13%	50%	37%	-

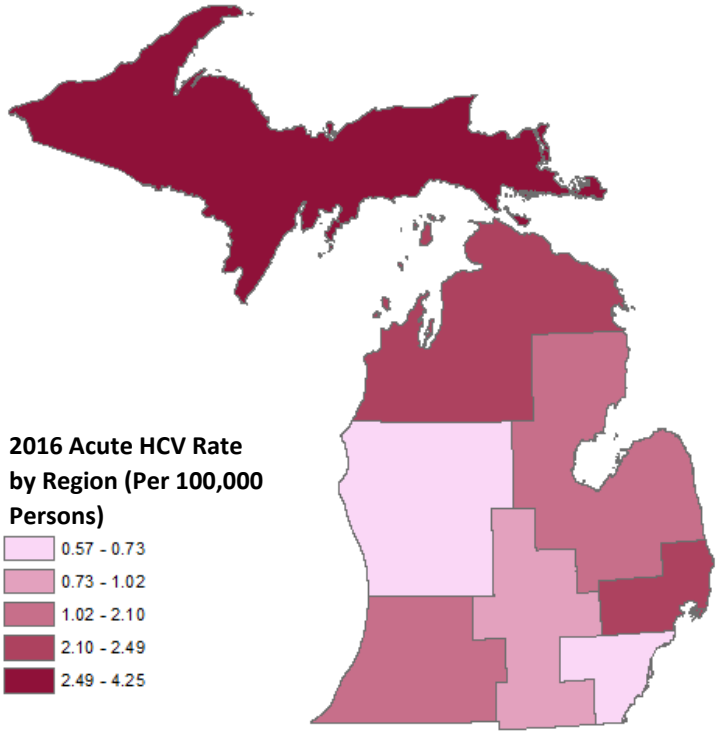
***** Percentages calculated based upon those who completed the field; excludes missing data

Table 4.4b 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. Only 1% of acute HCV cases reported being a hemodialysis patient.

Acute Hepatitis C Rate Maps by County, Local Health Jurisdiction, and Region







Chronic Hepatitis C

Chronic Hepatitis C—Incidence and Gender

Figure 5.1 Chronic Hepatitis C Cases per 100,000 Persons in Michigan 2012-2016

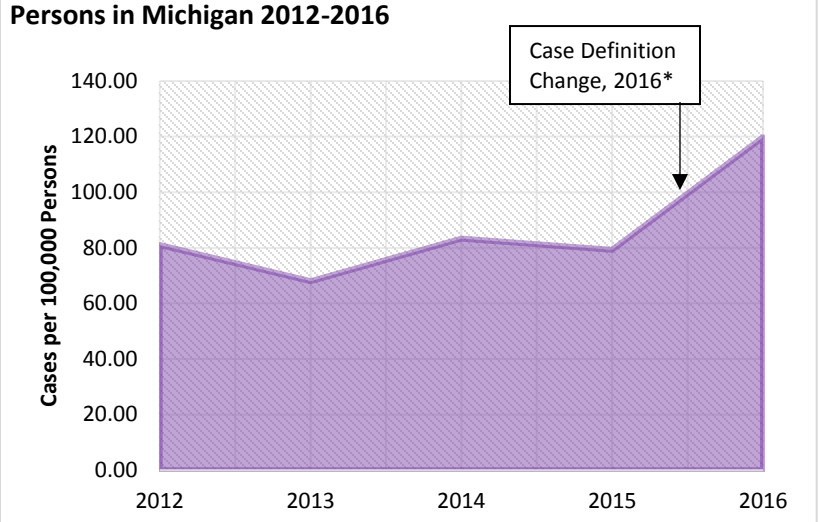


Table 5.1 Chronic Hepatitis C Cases per 100,000 Population in Michigan, 2012-2016

Year	Michigan Cases	Rate per 100,000
2012	8005	80.99
2013	6719	67.98
2014	8233	83.30
2015	7833	79.25
2016*	11883	119.76

There is no nationally available benchmark for comparing rates of chronic hepatitis. Decreases in 2013 cases may be due to increased de-duplication efforts, and removal of redundant cases, by MDHHS Viral Hepatitis Surveillance staff. Rates were relatively stable, with the exception of a notable increase in 2016 with 11,883 cases reported. This increase may be due to the change in Chronic Hepatitis C case definition in 2016.

Figure 5.2 Chronic Hepatitis C Cases per 100,000 Population by Gender in Michigan, 2012-2016

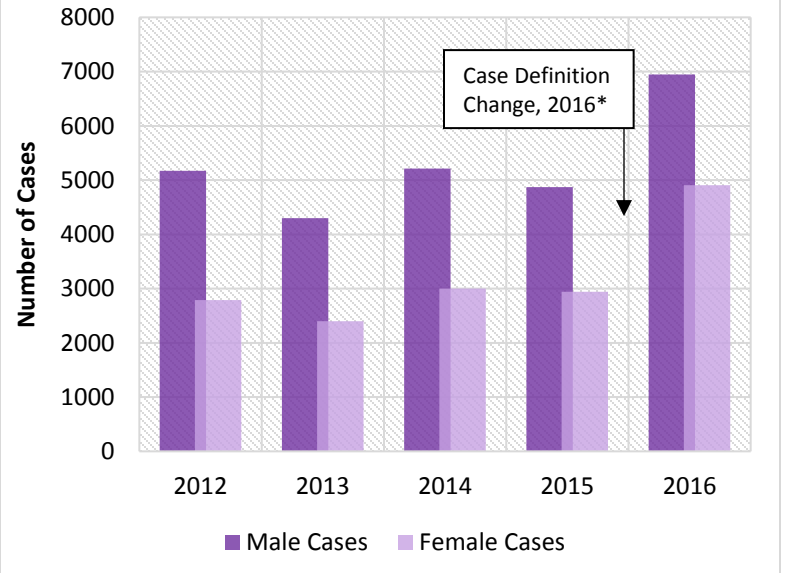


Table 5.2 Chronic Hepatitis C Cases per 100,000 Population by Gender in Michigan 2012-2016

Year	Male	Male Incidence	Female	Female Incidence
2012	5170	106.64	2791	55.43
2013	4299	88.67	2400	47.66
2014	5215	107.57	3000	59.58
2015	4873	100.51	2943	58.44
2016*	6946	142.42	4906	97.23

Males account for the majority of chronic hepatitis C cases reported each year since 2012. In 2016, the rate of chronic hepatitis C reports was 1.46 times higher in males than females. An 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 5.3 Chronic Hepatitis C Cases per 100,000 by Race and Ethnicity in Michigan, 2012-2016

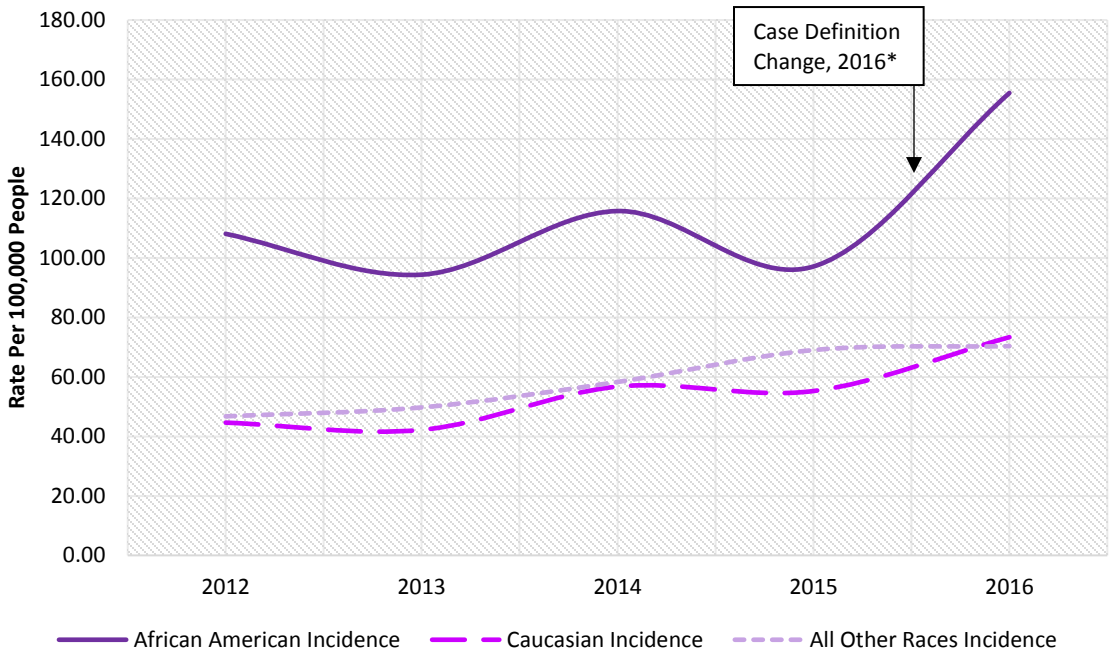


Table 5.3 Chronic Hepatitis C Cases per 100,000 by Race and Ethnicity in Michigan, 2012-2016

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	1496	108.11	58	106.10	35	14.80	3379	44.64	103	23.60	86	42.48
2013	1306	94.38	67	122.56	23	9.73	3194	42.19	97	22.23	90	44.46
2014	1602	115.77	67	122.56	45	19.03	4296	56.75	167	38.27	108	53.35
2015	1344	97.13	86	157.32	44	18.61	4183	55.26	144	33.00	136	67.18
2016*	2119	155.46	69	149.82	51	17.45	5492	73.36	213	43.83	175	70.35

In 2016, African Americans had the highest rate of chronic hepatitis C virus and are disproportionately infected compared to other racial groups. Increases in case counts and rates between 2015 and 2016 may be the result of the change in the national HCV case definition.

In this report we switched from using the 2010 Census to using 2015 Census estimates for calculation of infection rates. This explains why the infection rate for Asians went down even though the case count went up.

Chronic Hepatitis C—Risk Behaviors

Table 5.4a Completeness of Chronic Hepatitis C Reports by Risk Behavior, Michigan, 2016

Risk Behavior	Completed
Received Blood Transfusion Prior to 1992	70%
Received an Organ Transplant Prior to 1992	69%
Received Clotting Factor Concentrates Prior to 1992	69%
Hemodialysis	69%
Injection Drug User	71%
Incarcerated in Lifetime	67%
Treated for a Sexually Transmitted Disease in Lifetime	67%
Contact of Person with Hepatitis C	69%
Employed in Medical Field	68%

Table 5.4a shows the percentage of chronic hepatitis C risk behavior questions completed by local health department staff in 2016. 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 69% of case reports. This is similar to 2015, but an increase from previous 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 5.4b 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. A high proportion of unknown indicates that local health departments tried, but were unable to solicit information from patients and/or their providers.

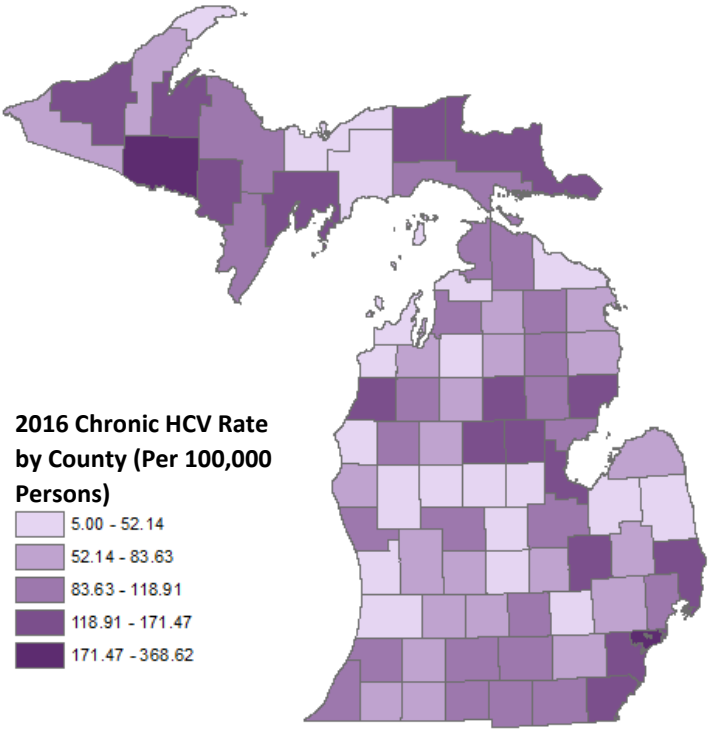
Table 5.4b Response of Completed Chronic Hepatitis C Reports by Risk Behavior, Michigan, 2016*

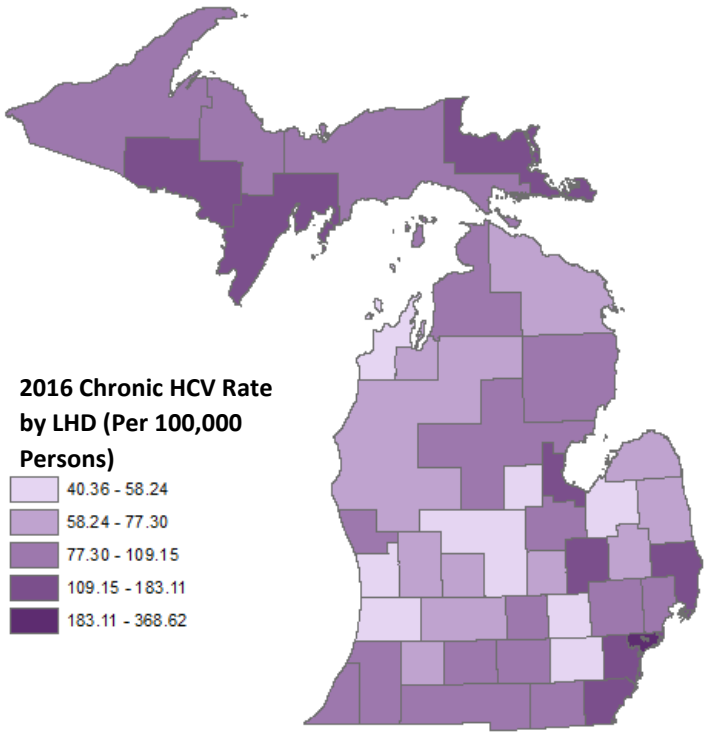
Risk Behavior	Yes*	No*	Unknown*
Received Blood Transfusion Prior to 1992	3%	32%	65%
Received an Organ Transplant Prior to 1992	0%	40%	60%
Received Clotting Factor Concentrates Prior to 1992	0%	35%	65%
Hemodialysis	1%	39%	60%
Injection Drug User	28%	16%	56%
Incarcerated in Lifetime	22%	13%	65%
Treated for a Sexually Transmitted Disease in Lifetime	8%	22%	70%
Contact of Person with Hepatitis C	15%	12%	73%
Employed in Medical Field	3%	31%	66%

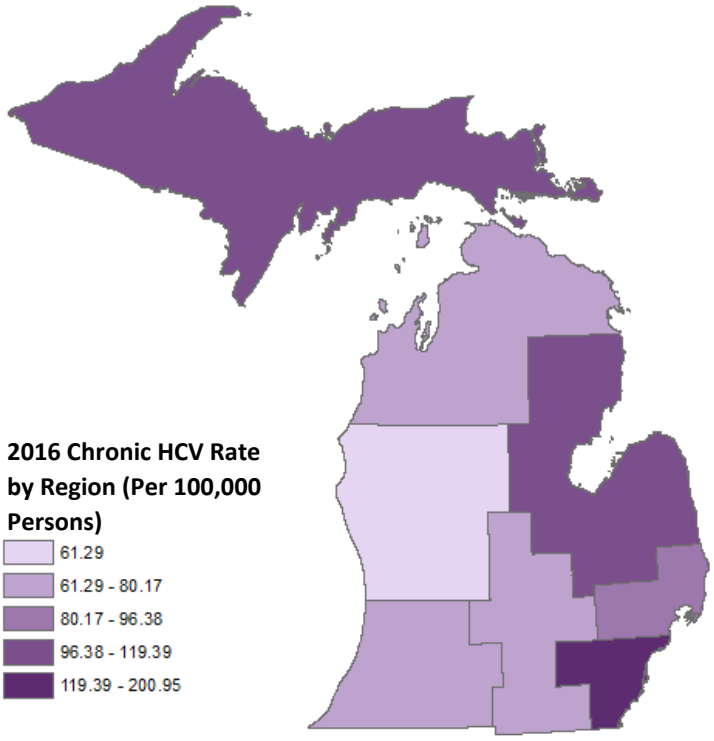
* Percentages calculated based upon those who completed the field; excludes missing data

Note: Risk factors and responses are not mutually exclusive

Chronic Hepatitis C Rate Maps by County, Local Health Jurisdiction, and Region







Hepatitis C Testing & Treatment

Hepatitis C—Testing and Genotype Data

Figure 6.1 CDC Recommended Testing Algorithm for Hepatitis C Virus Infection

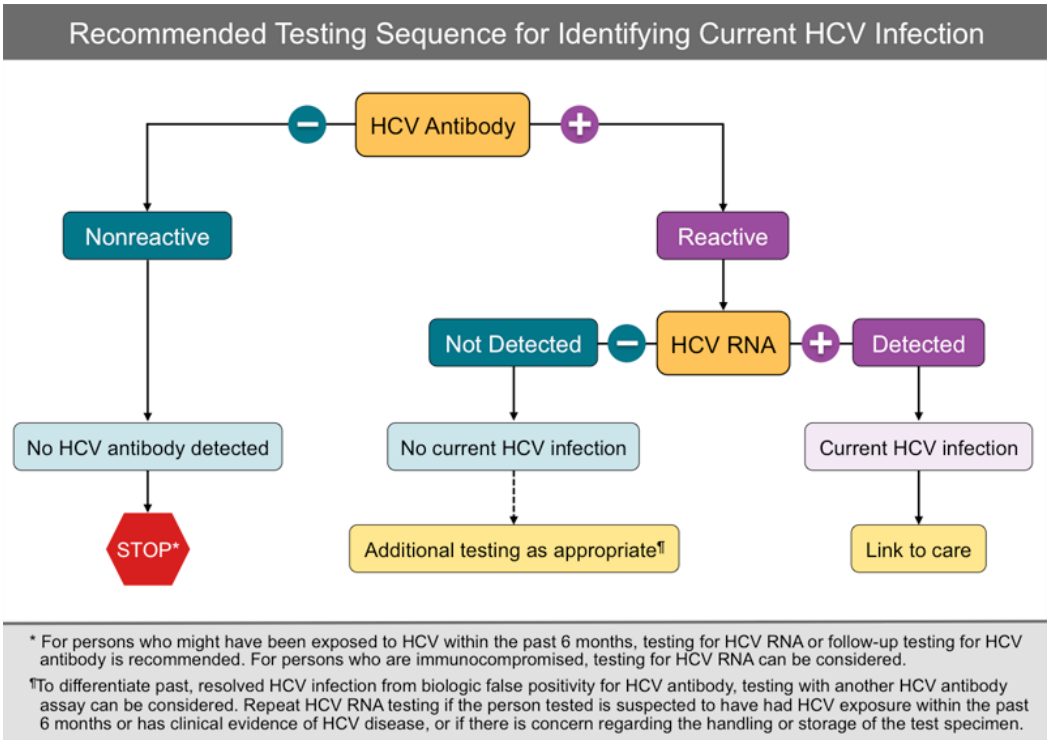
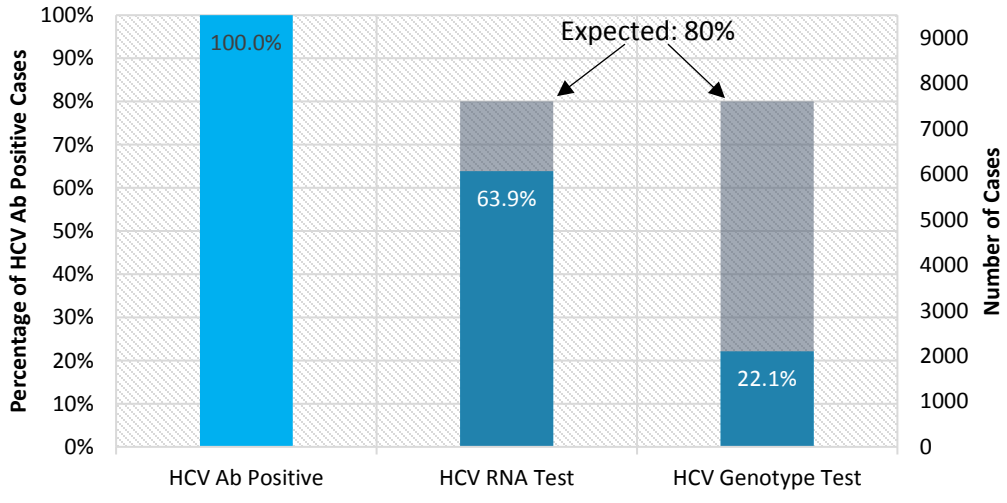


Figure 6.2 Number and Percentage of HCV Antibody Positive Cases with an HCV RNA or HCV Genotype Test, 2016



Of the 11,890 cases of acute and chronic hepatitis C reported in Michigan in 2016, about 9,500 (80%) cases were reported with a positive HCV antibody results. Of those cases, 63.9% were reported with positive HCV RNA test and even fewer (22.1%) 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 clinicians. These data suggest a small gap in getting HCV antibody positive patients confirmatory testing, but a large gap in genotype testing which indicates engagement in treatment.

Hepatitis C Bureau of Labs (BOL) Testing

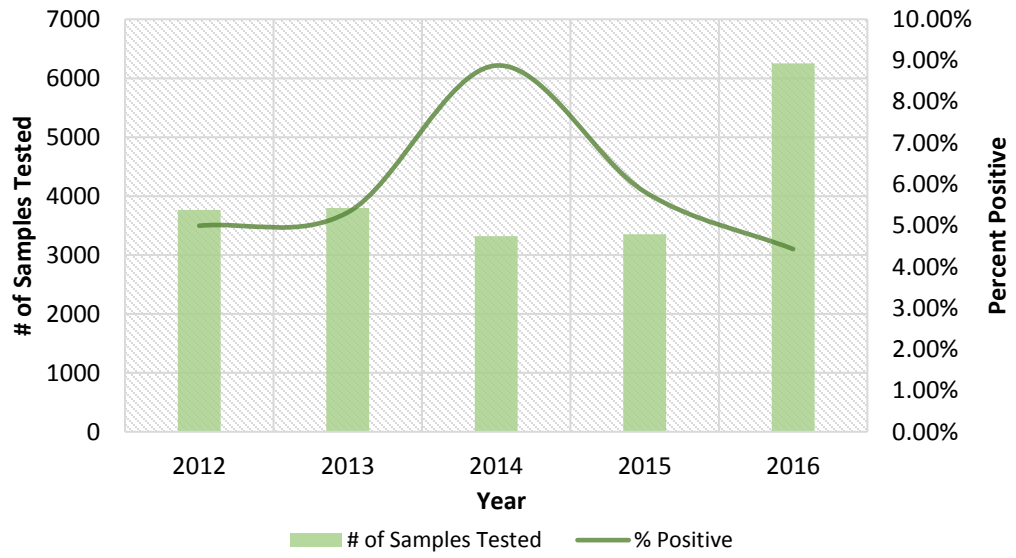
The MDHHS Bureau of Laboratories (BOL) has historically performed testing for HCV antibody. In 2014, the virology lab began performing HCV RNA testing for all specimens testing positive for HCV antibody in recognition of CDC's HCV testing algorithm. The data below look at the number of tests conducted 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 6.1 BOL HCV Antibody Tests, 2012-2016

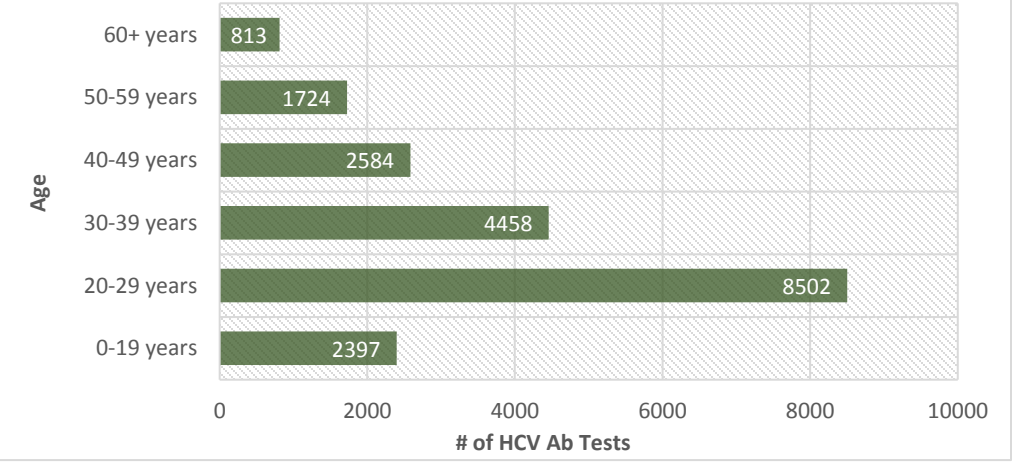
Year	# of Samples Tested	# of Unsatisfactory or Not Tested	# Negative	# Positive	% Positive
2012	3764	6	3575	188	5.00%
2013	3798	7	3596	202	5.32%
2014	3321	26	2935	286	8.88%
2015	3351	25	3156	195	5.82%
2016	6252	33	5975	277	4.43%

Figure 6.6 BOL HCV Antibody Tests by Year



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. Of the samples tested each year from 2012-2016, between 4-5% of them were positive, with the exception of 2014 where 8.88% of tests had positive results.

Figure 6.7 All HCV Antibody Tests by Age, 2012-2016



Of the 20,486 HCV Ab tests ran from 2012-2016, 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, comprising only 4.0% of all individuals tested for HCV Ab.

Table 6.2 BOL HCV PCR Testing, 2014-2016

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%

Figure 6.8 BOL HCV PCR Testing by Year, 2014-2016

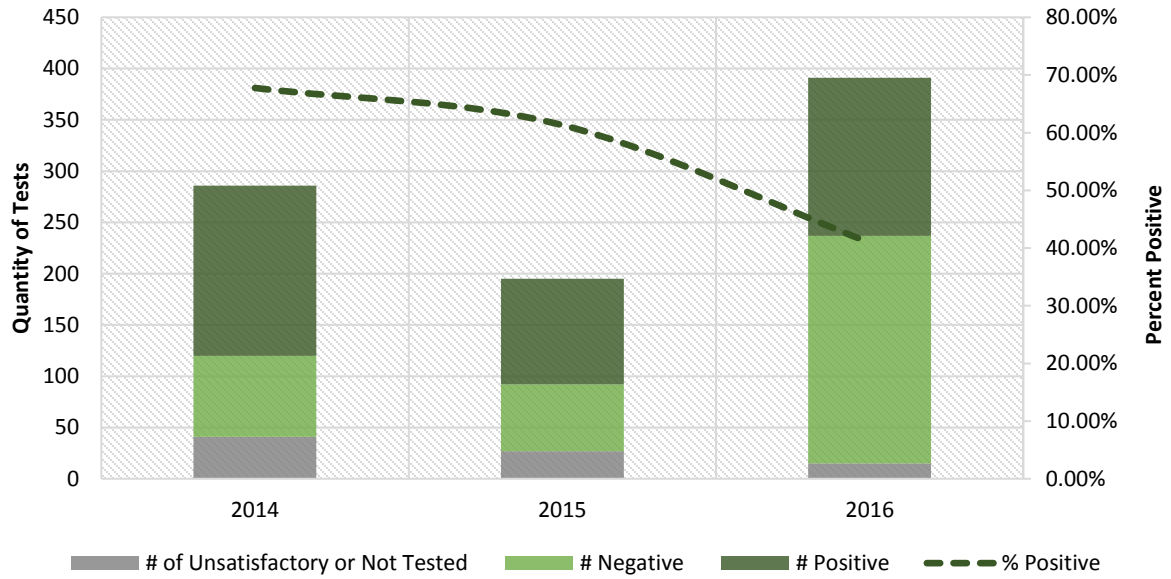
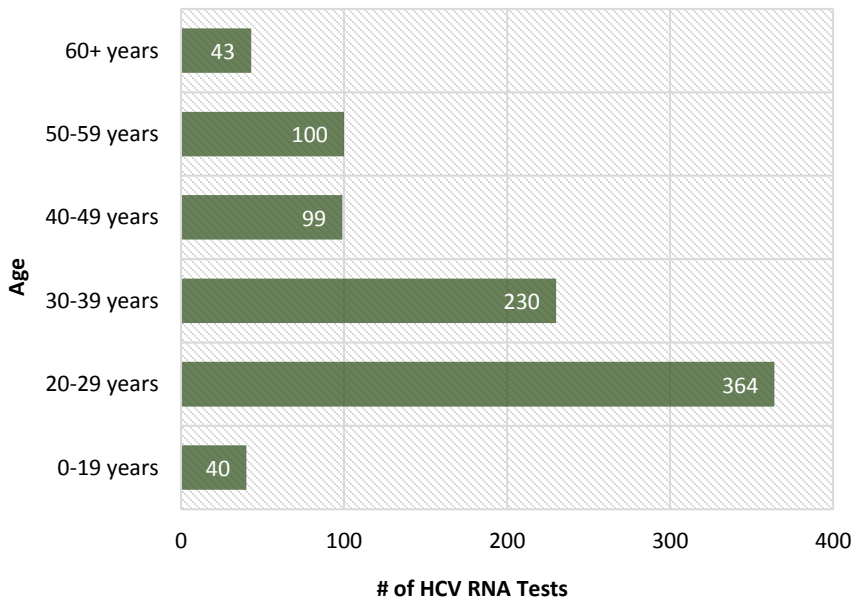


Figure 6.9 All HCV RNA Tests Stratified by Age, 2014-2016



The number of PCR tests conducted by the BOL decreased in 2015, but then doubled in 2016 to a total of 378 tests analyzed. With an increase in the quantity of test performed, the percentage of tests that yielded positive results decreased from 61.31% in 2015 to 40.96% in 2016.

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 876 HCV RNA tests ran by BOL from 2014-2016, 41.6% of individuals were 20-29 years old. The smallest proportion of tests were found amongst those 0-19 years old (4.6%) and those 60 years of age and older (4.9%).

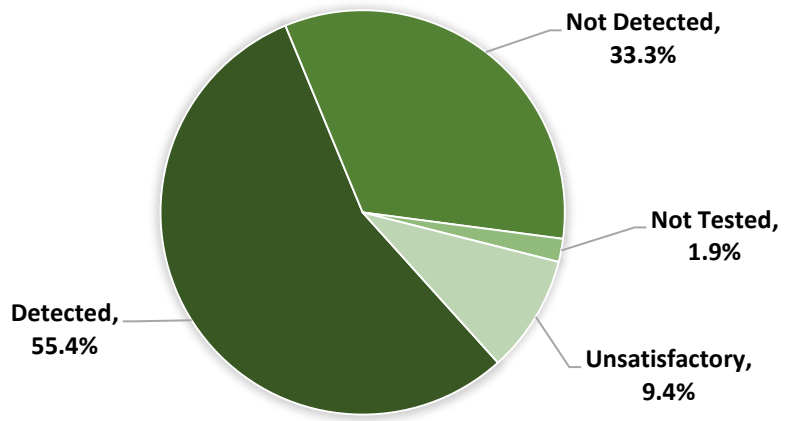
Table 6.3 BOL Patient Demographics for Patients Testing HCV Antibody/RNA Positive 2014-2016

Variable	n	%
N	756	
Sex		
Male	417	55.20%
Female	329	43.50%
Unknown	10	1.30%
Race		
American Indian/Alaskan Native	3	0.40%
Asian	2	0.30%
Black or African American	94	12.40%
Native Hawaiian/ Pacific Islander	1	0.10%
White or Caucasian	601	79.50%
Multiracial	6	0.80%
Other	7	0.90%
Unknown	42	5.60%
Age		
0-19	30	4.00%
20-29	311	41.10%
30-39	204	27.00%
40-49	88	11.60%
50-59	86	11.40%
60+	37	4.90%

There were 756 patients who tested positive for HCV antibody and/or RNA at BOL between 2014-2016. Just over half (55.2%) of individuals who tested positive were male. The majority (79.5%) of those who were positive were Caucasian, which was much higher than African Americans who only comprised 12.4% of positive test results. In addition, 41.1% of individuals who tested positive were 20-29 years old. This is much higher than the baby boomer population, which only accounted for about 11.4% 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 6.10 PCR Test Results following a Positive HCV Antibody Test 2014-2016

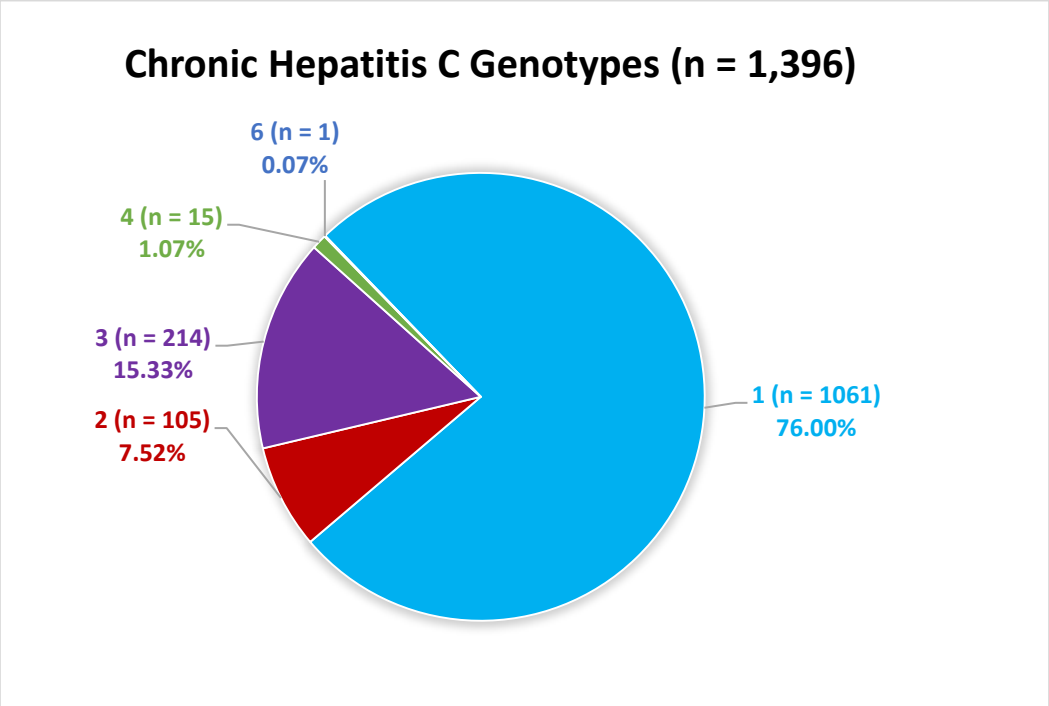


Of the 756 positive HCV screen tests, just over half (55.4%) had a positive PCR test result. One-third of positive HCV screen tests were negative by PCR (33.3%).

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.

In addition, 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 22% receiving an HCV genotype test, suggesting that many patients are not yet being evaluated for HCV therapy.

Figure 6.4 Prevalence of Genotypes of Chronic Hepatitis C Cases Reported, Michigan, 2016



A total of 1,396 chronic HCV patients had a genotype reported to MDHHS in 2016. Of these, 76.00% were reported with genotype 1 infection (84.08% were subtype 1a and 15.92% 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 only about 1% of all genotyped specimens in 2016.

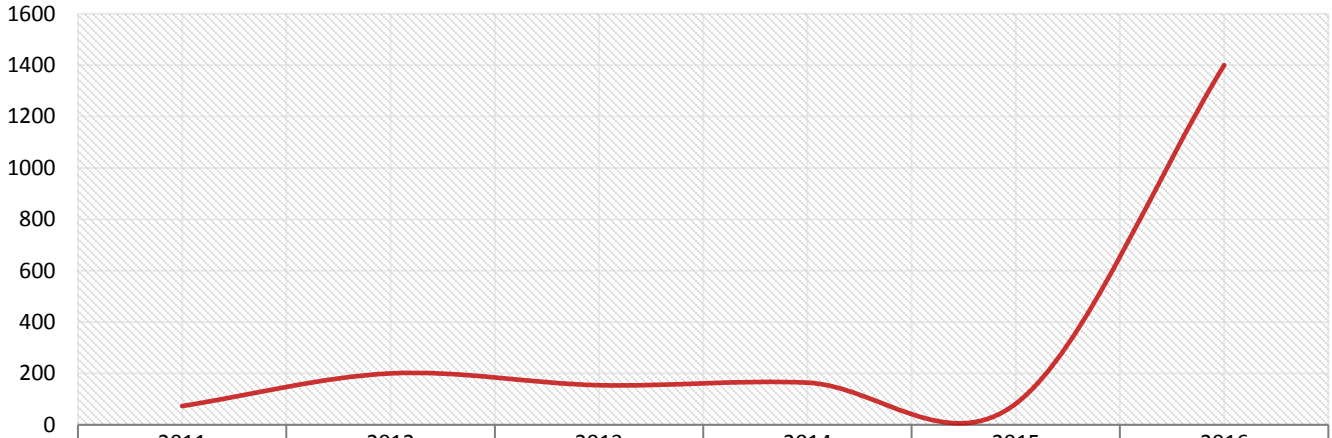
This pattern of genotypes is consistent with the expected annual proportions in Michigan. The data is also consistent with the national distribution, as the predominant genotypes nationwide are 1a, 1b, 2a, 2b, and 3a.

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 10.5 looks at the number of Michigan Medicaid patients that had gotten appropriate testing to be prescribed various HCV treatments from 2011 to 2016. Older drugs, like Incivek and Victrelis, are no longer prescribed as superior products are now available (e.g. Sovaldi, Viekira). 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 persons with Medicaid insurance with HCV infection. According to these data, with 2,073 unique persons treated for HCV, approximately 4-8% 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.

Figure 10.5 Total Number of Medicaid Members with Prescriptions, by Medication, 2011-2016



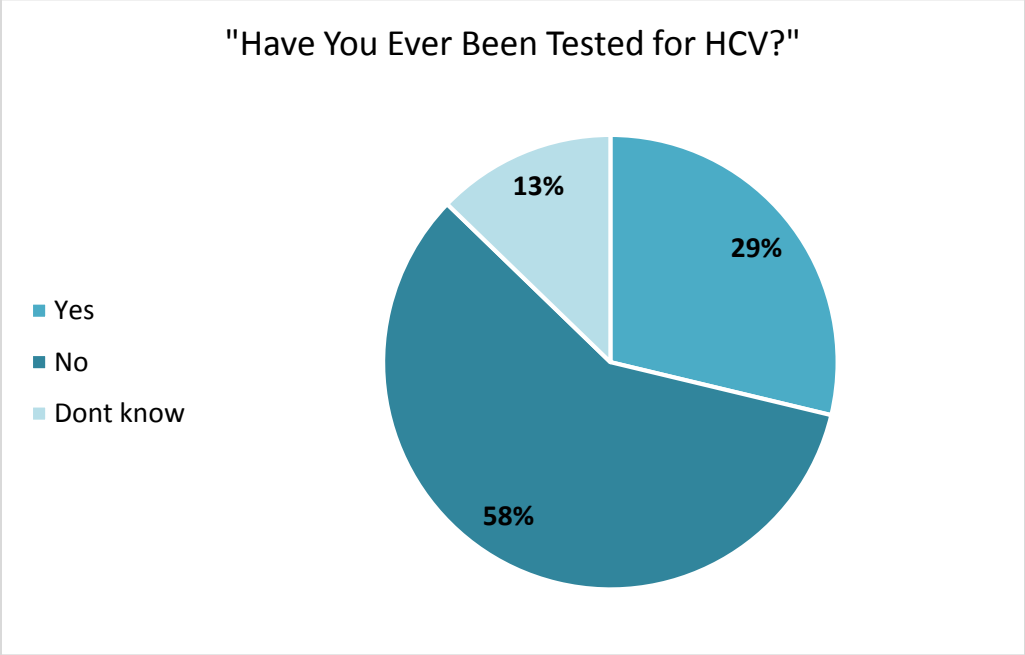
	2011	2012	2013	2014	2015	2016
Victrelis	20	117	104	23		
Incivek	53	83	48	2		
Sovaldi			2	125	24	110
Harvoni				5	53	1008
Olysio				9	1	1
Daklinza					2	84
Viekira Pak					2	13
Epclusa						151
Technivie						2
Zepatier						31
TOTAL	73	200	154	164	82	1400

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 2015 MIBRFS to determine demographic and behavioral factors associated with HCV testing. Data collected from the MiBRFS in 2015 (N=2689) was stratified based on HCV testing status and analyzed by various socio-demographic and behavioral factors.

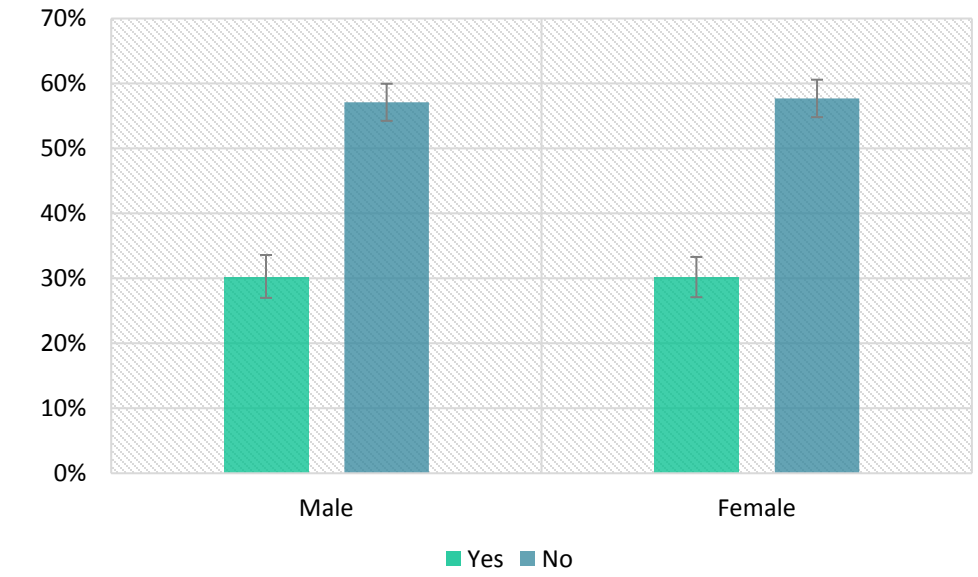
We hope to monitor trends in these data over time to determine if HCV testing is increasing. In addition, the information provided will help us develop targeted strategies to increase HCV testing.

Figure 6.11 Frequency of 2015 MiBRFSS participants ever tested for Hepatitis C



A total of 2,689 participants responded to the question "Have you ever been tested for HCV" in the 2015 MiBRFS. Of these participants, 773 (29%) reported ever being tested for HCV while over half (58%, 1,573 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.

Figure 6.12 MiBRFSS "Ever tested for HCV?" by Sex



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

Table 6.4 MiBRFSS "Ever tested for HCV?" by Race

Race	Yes	No
Caucasian	26.4% (24.0-28.8)	60.4% (57.6-63.0)
African American	48.8% (41.2-56.6)	42.1% (34.6-50.0)
Other/Multi-racial	48.4% (35.1-61.8)	40.8% (28.5-54.3)
Hispanic	52.1% (37.3-66.5)	45.1% (31.0-60.0)

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 6.5 MiBRFSS "Ever tested for HCV?" by Age

Age	Yes	No
18-49 years	36.8% (33.0-40.8)	50.9% (46.8-55.0)
50-70 years	27.2% (24.3-30.2)	60.6% (57.2-63.9)
71+ years	13.6% (10.3-17.7)	73.4% (68.4-77.8)

"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 (27.2% compared to 36.8%). Those over 70 years old were the least likely to report ever being tested for HCV (13.6%).

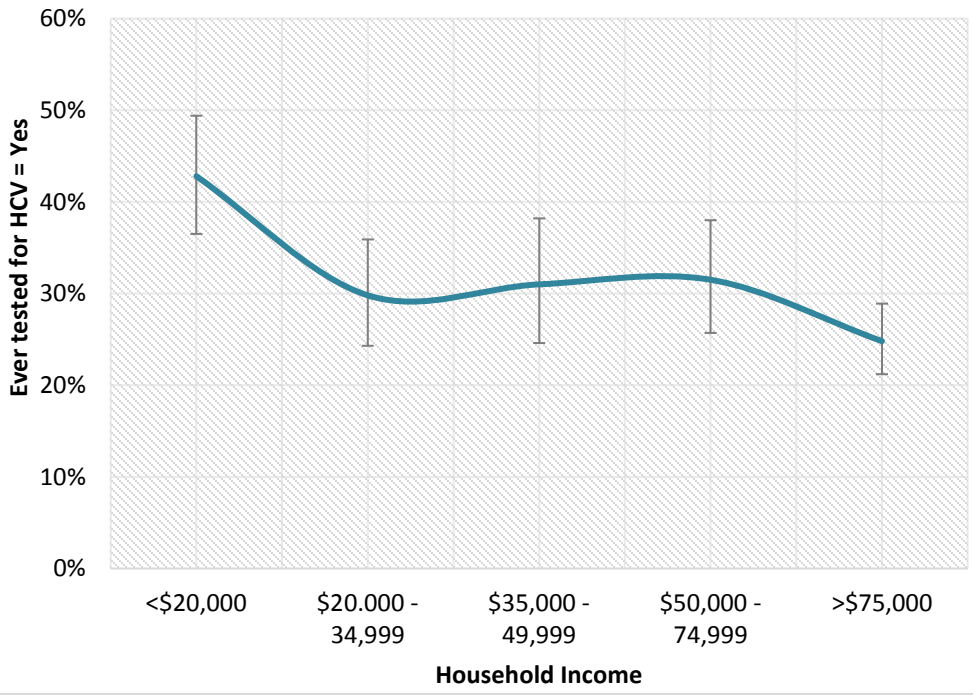
Future HCV screening campaigns may want to focus on the Baby Boomer birth cohort screening recommendation.

Table 6.6 MiBRFSS "Ever tested for HCV?" by Insurance Type

	Private	Medicaid	Medicare	Healthy Michigan	Medicaid + Medicare	None
Yes	29.1% (25.7-32.8)	50.2% (40.3-60.1)	23.9% (20.2-28.1)	44.8% (27.7-63.3)	32.3% (26.5-38.6)	28.0% (20.8-36.5)
No	58.6% (54.7-62.3)	38.4% (28.9-48.8)	64.5% (60.1-68.6)	52.7% (34.2-70.5)	54.7% (48.2-61.1)	54.2% (44.9-63.3)

Not having insurance or having public insurance is often seen as a barrier to receiving HCV testing. However, according to the BRFS survey, persons with Medicaid were more likely to be tested for HCV than those with private insurance. Of the public insurance options, Medicaid members were the most likely to have ever been tested for HCV (50.2%). The proportion of persons with no health insurance (28.0%) tested for HCV was about the same as those with private insurance (29.1%). This might suggest that persons with private insurance are less likely to have risk factors for HCV exposure and therefore are not indicated for HCV testing compared to those with public or no insurance. But these data could also mean that insurance status may not be as large of a barrier to HCV testing as the perception suggests.

Figure 6.13 MiBRFS Ever tested for HCV? by Household Income

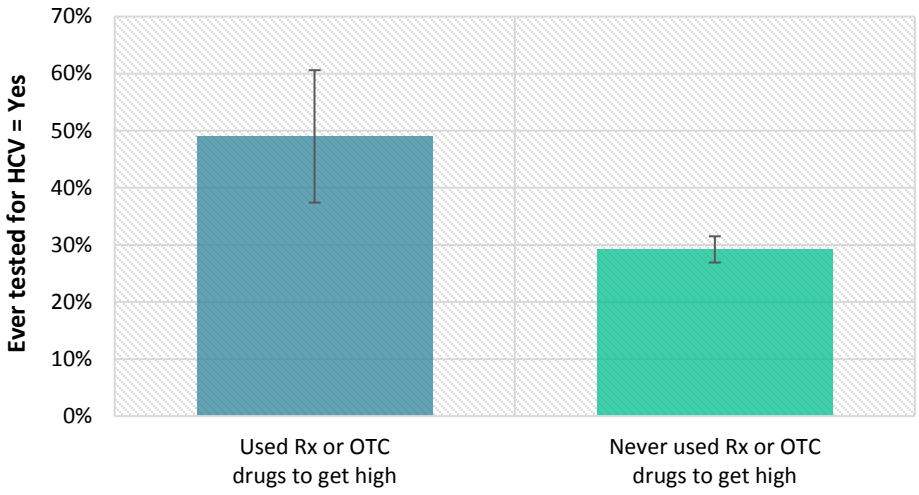


It is thought that those with lower income experience significant barriers to receiving diagnostic testing services.

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.

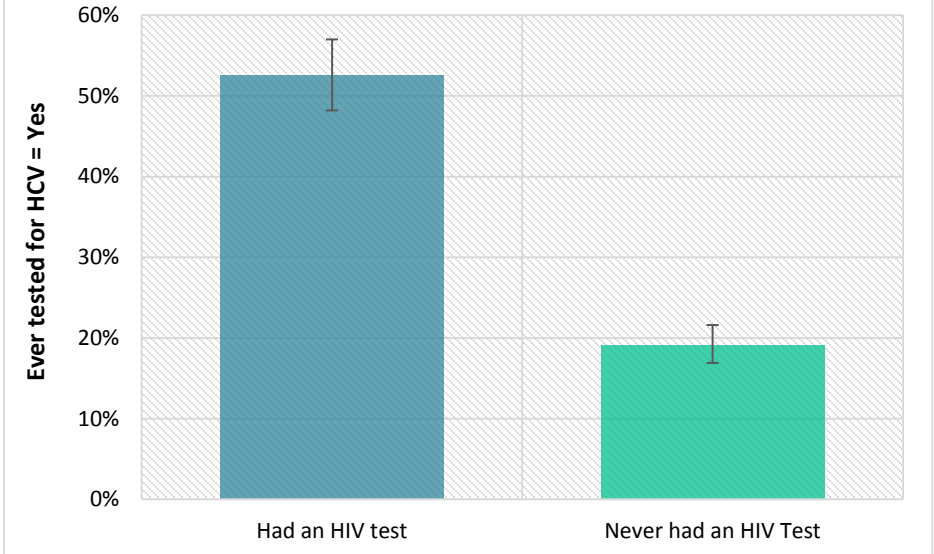
This might suggest that persons with higher income are less likely to have risk factors for HCV exposure compared to those with lower income and therefore are not indicated for HCV testing. But it also indicates that low income may not be a major barrier to HCV testing as the perception would suggest.

Figure 6. 14 MiBRFS Ever been tested for HCV? by use of Prescription (Rx) or Over-the-counter (OTC) Drugs to get High



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%).

Figure 6.15 MiBRFS Ever tested for HCV? by History of being tested for HIV



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)

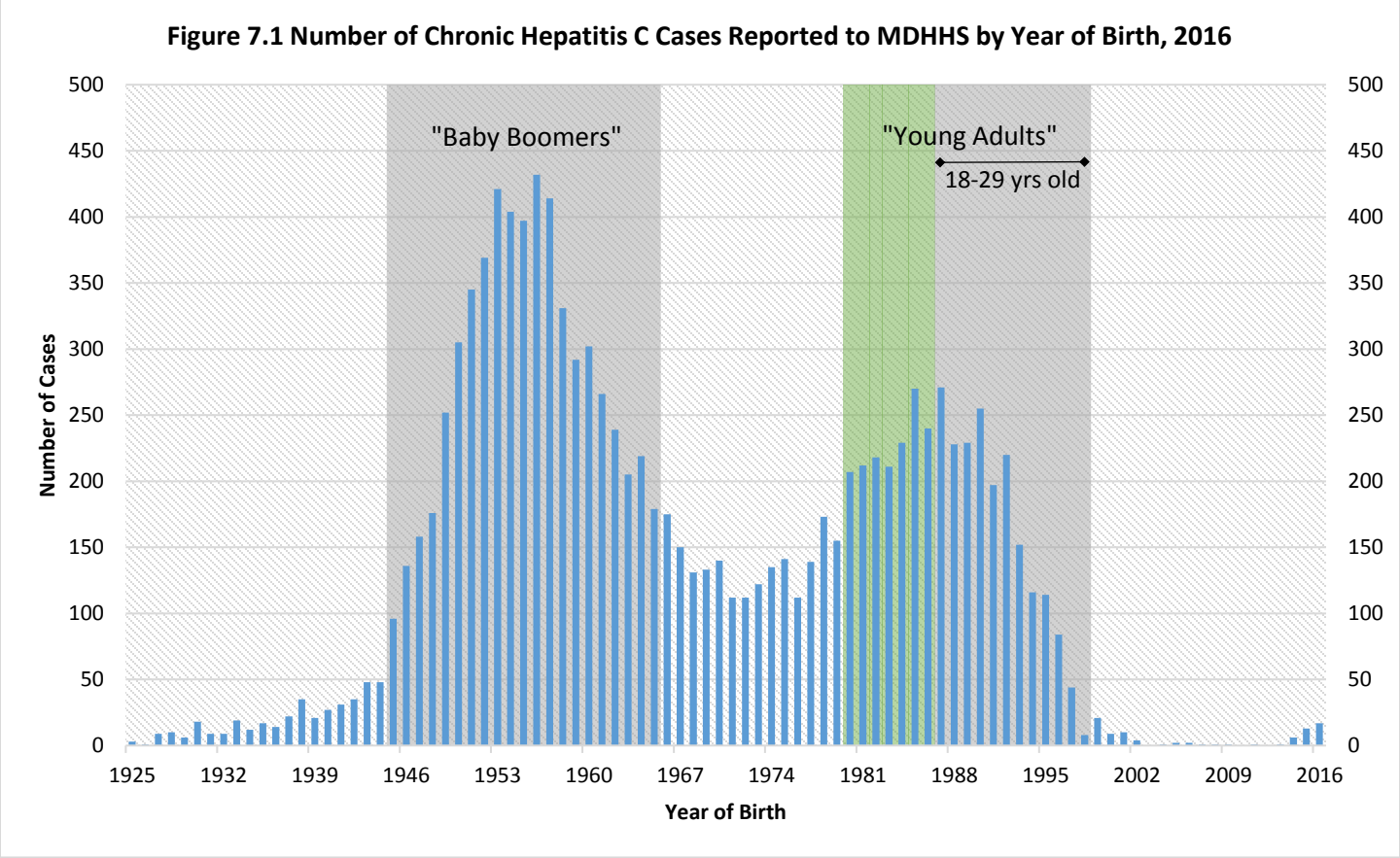


Figure 7.1 depicts the number of chronic hepatitis C cases reported to MDHHS by birth year in 2016. "Baby Boomers", those born between 1945 and 1965, are five times more likely than other adults to be infected with hepatitis C according to national statistics. CDC now recommends one-time hepatitis C testing of everyone born between 1945 and 1965. MDHHS data shows that the number of new chronic hepatitis C diagnoses in persons born between 1945 and 1965 is the largest of any other birth cohort.

However, in recent years a second smaller 'peak' of new chronic hepatitis C 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 7.1). 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 7.2 Number of Chronic Hepatitis C Cases Reported to MDHHS by year, 18-29 years of age, 2000-2016

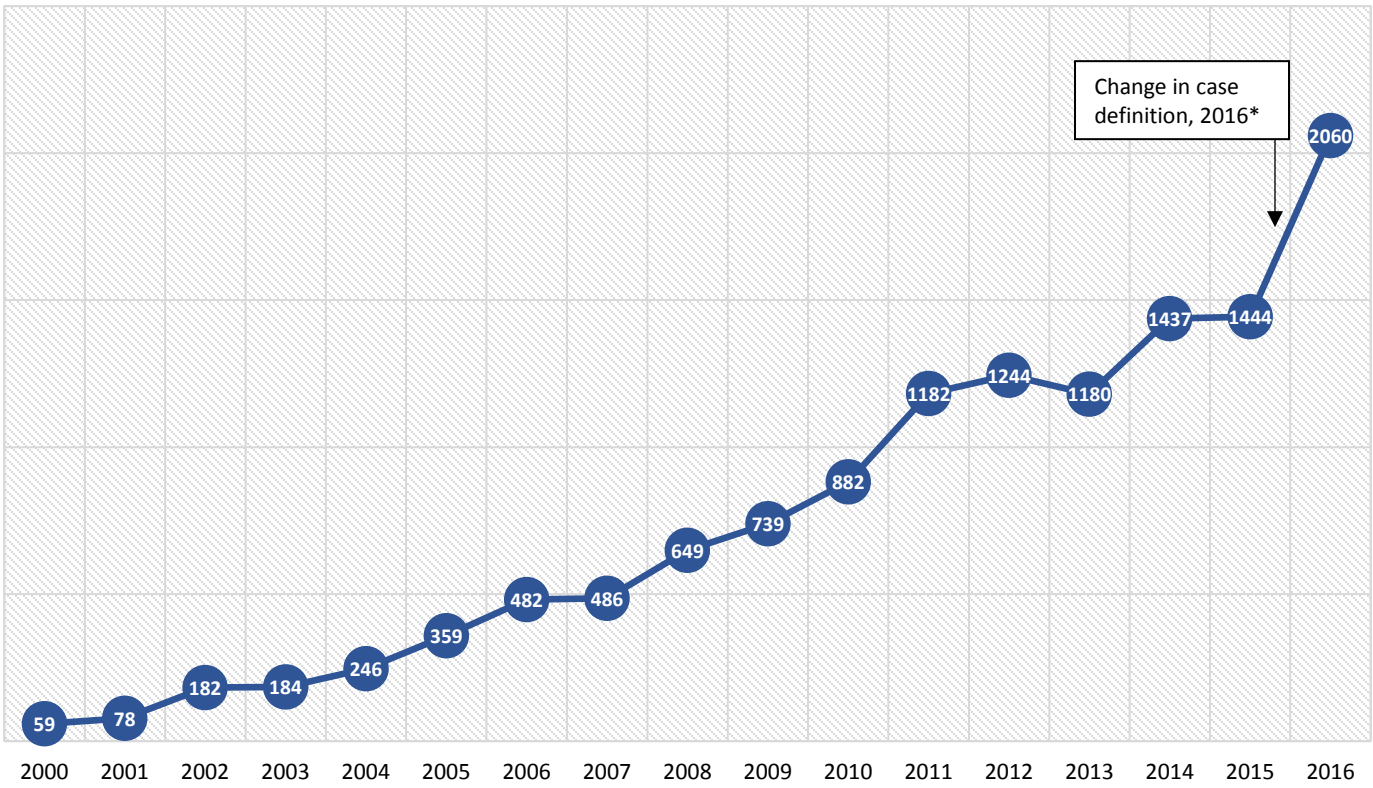


Table 7.1 Number and Percentage of Chronic Hepatitis C cases reported to MDHHS aged 18-29, 2000-2016

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
Total Cases	1498	2486	4296	4638	5169	7347	8117	6998	8464	7732	7214	8006	7967	6703	8233	7833	11883
Number of Cases 18-29 Years Old	59	78	182	184	246	359	482	486	649	739	882	1182	1244	1180	1437	1444	2060
Percentage of Total Cases	4%	3%	4%	4%	5%	5%	6%	7%	8%	10%	12%	15%	16%	18%	17%	18%	17%

Since 2000 the number of chronic hepatitis C diagnoses among persons 18 to 29 years of age have increased every year, with the exception of 2013 (Figure 7.2). More specifically, the number of cases has increased 212% per year between 2000 and 2016. The dramatic rise in new HCV diagnoses in this population in 2016 can be partially explained by the change in case definition. However, the increasing year-over-year trend likely plays a role as well. As you can see from Table 7.1, 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 7.2 Epidemiologic Summary of 2016 Chronic HCV Cases Aged 18-29 Years Old

Age (n = 2060)		
Median	25	
Mean	24.96	
Range	18 - 29	
Sex (n = 2057)		**Rate per 100,000**
Female	967 (47.0%)	124.92
Male	1090 (53.0%)	138.09
Race (n = 1524)		**Rate per 100,000**
White	1351 (88.6%)	110.60
Black	139 (9.1%)	54.04
American Indian	22 (1.4%)	178.43
Asian	12 (0.8%)	24.38
Hispanic Ethnicity (n = 1163)		**Rate per 100,000**
Hispanic or Latino	40 (3.4%)	45.77
Not Hispanic or Latino	1123 (96.6%)	71.83
Arab Ethnicity (n = 803)		**Rate per 100,000**
Arab Ethnicity	7 (0.9%)	Not Available
Non-Arab	796 (99.1%)	Not Available
History of IVDU (n = 978)		
Yes	823 (84.2%)	
No	155 (15.8%)	

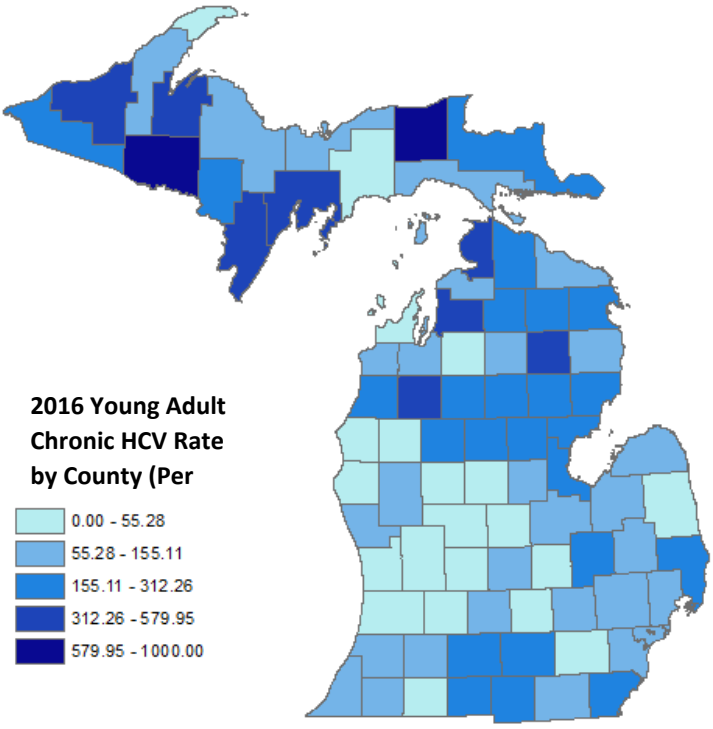
Previous studies conducted by MDHHS have shown injection drug use as the primary risk factor for HCV acquisition among those aged 18-29 years old. In many instances these clients reported sharing needles, syringes, and other injection drug works (such as cookers and cotton) which could have acted as vectors for HCV transmission. Increases in heroin overdoses and heroin substance abuse treatment admissions (see subsequent pages) likely represent an increase in heroin use, which may explain the rise in HCV cases in the young adult population.

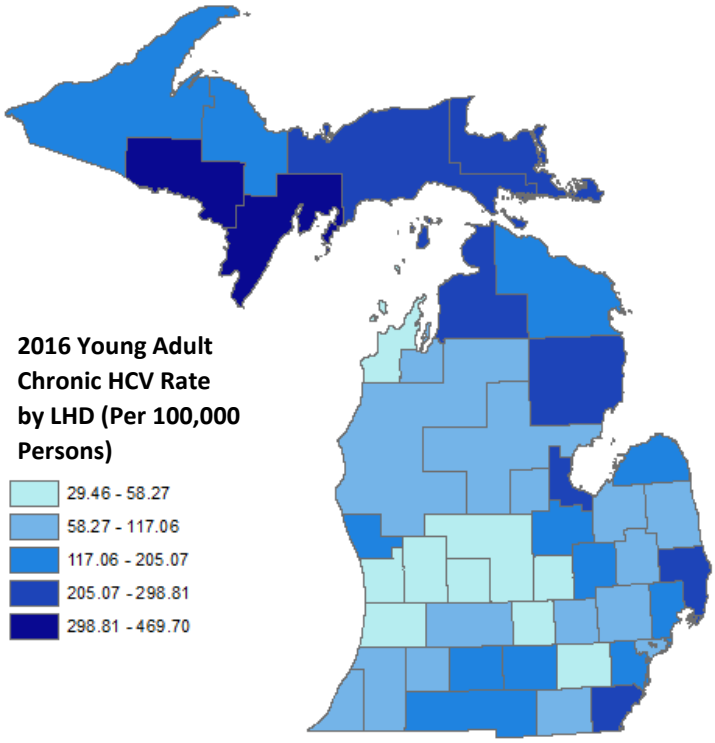
A demographic breakdown of the chronic HCV cases aged 18-29 years old who were diagnosed in 2016 (Table 7.2) shows that the vast majority were white, non-Hispanic, and non-Arab with an approximately even gender distribution. Where injection drug use information was available on these patients, 84.2% reported a history of IVDU.

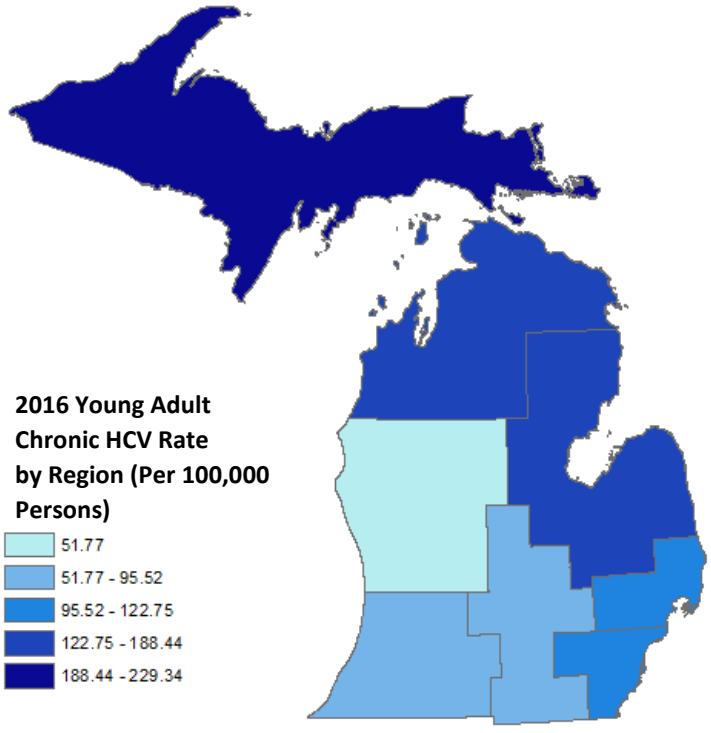
Maps of the rates of 2016 chronic HCV cases among 18-29 year olds, 2016 heroin treatment admissions, and 2015 non-heroin opioid overdose deaths and heroin overdose deaths by county, local health jurisdiction and region can be found below. More detailed information on hepatitis C infection in young adults 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, Local Health Jurisdiction, and Region







Heroin Abuse and Treatment Data

Figure 7.3 Number Heroin Substance Abuse Treatments Admissions and Deaths in Michigan, 2000-2016

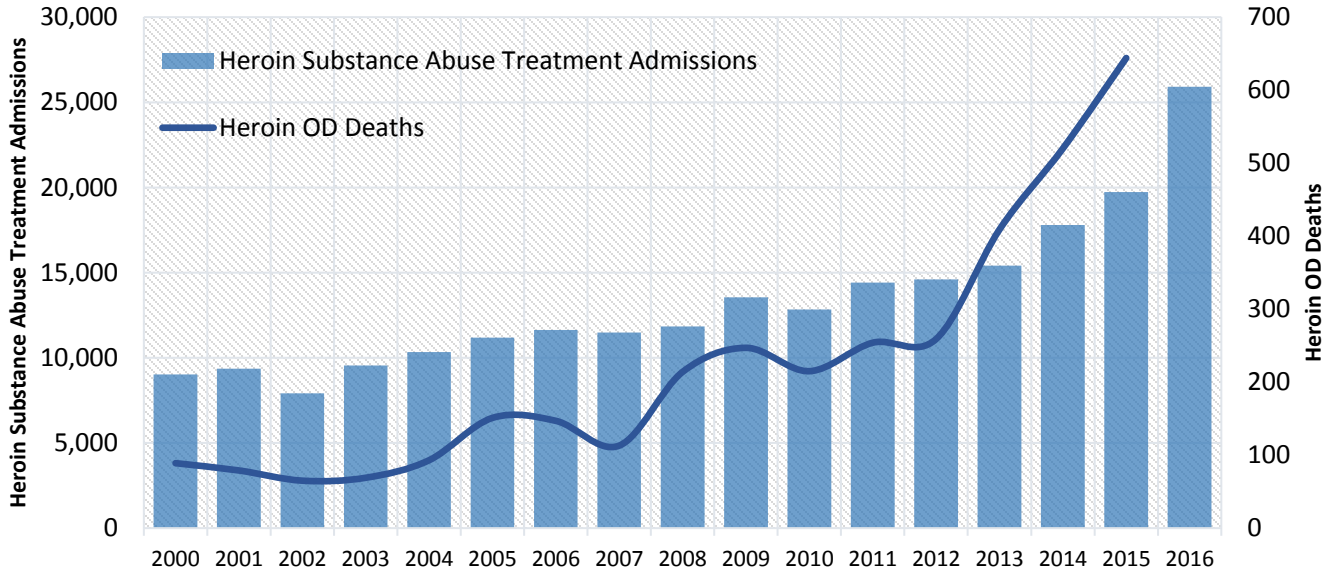


Table 7.3 Number Heroin Substance Abuse Treatments Admissions and Deaths in Michigan, 2000-2016

Year	Heroin OD Deaths	Heroin Substance Abuse Treatment Admissions	Number of Chronic HepC Cases 18-29 Years Old
2000	89	9,023	59
2001	79	9,367	78
2002	65	7,921	182
2003	69	9,558	184
2004	93	10,331	246
2005	151	11,182	359
2006	147	11,642	482
2007	113	11,481	486
2008	214	11,843	649
2009	247	13,548	739
2010	215	12,836	882
2011	254	14,413	1,182
2012	259	14,596	1,244
2013	409	15,419	1,180
2014	520	17,800	1,437
2015	644	19,728	1,444
2016	-	25,910	2,060

Table 7.3 depicts that, over this same time frame, Michigan has seen a parallel increase in the number of heroin overdose deaths and heroin substance abuse treatment admissions. Heroin substance abuse treatment admissions grew from 9,023 in 2000 to 25,910 in 2016 while the number of heroin overdose deaths increased from 89 in 2000 to 644 in 2015.

Heroin overdose death data is obtained from the Michigan Death Records. 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 T40.1. Opioid deaths are those with 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

In similar fashion to the heroin and substance abuse treatment 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).

Though we believe our query to be relatively reliable 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.

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 45% increase in the number of ED syndromic visits related to this query between 2013 and 2016 indicating that opioid and heroin related ED visits are on the rise.

Figure 7.4 Emergency Department Encounters for Substance Abuse Instances, Syndromic Surveillance System, Jan 2013-Mar 2017

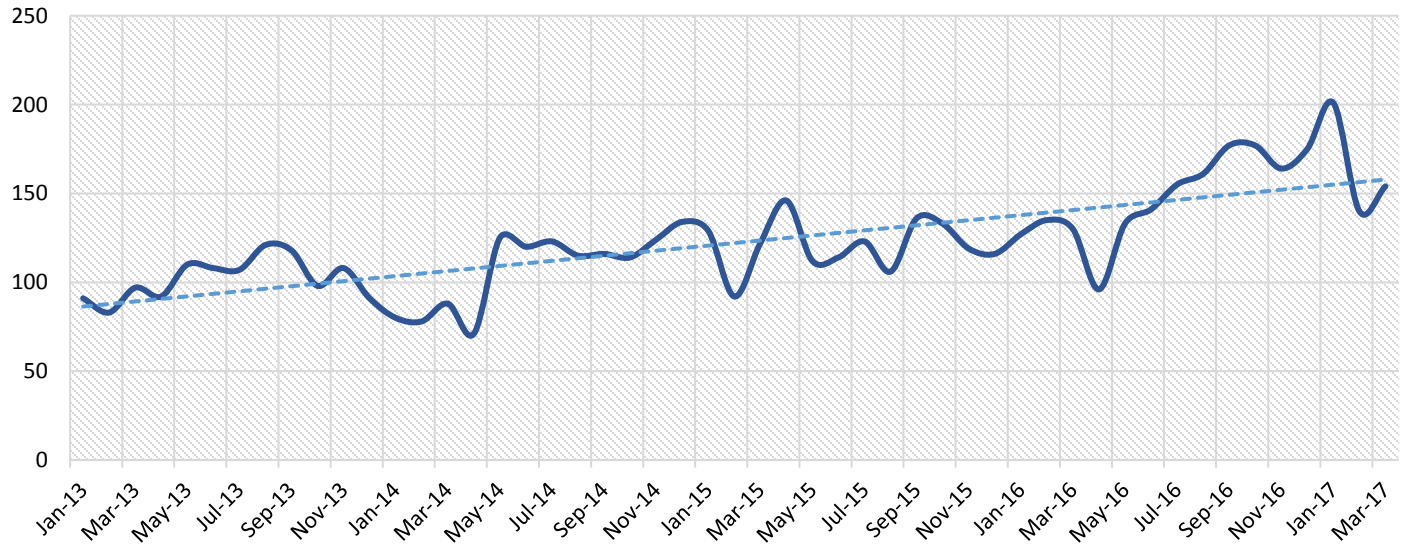
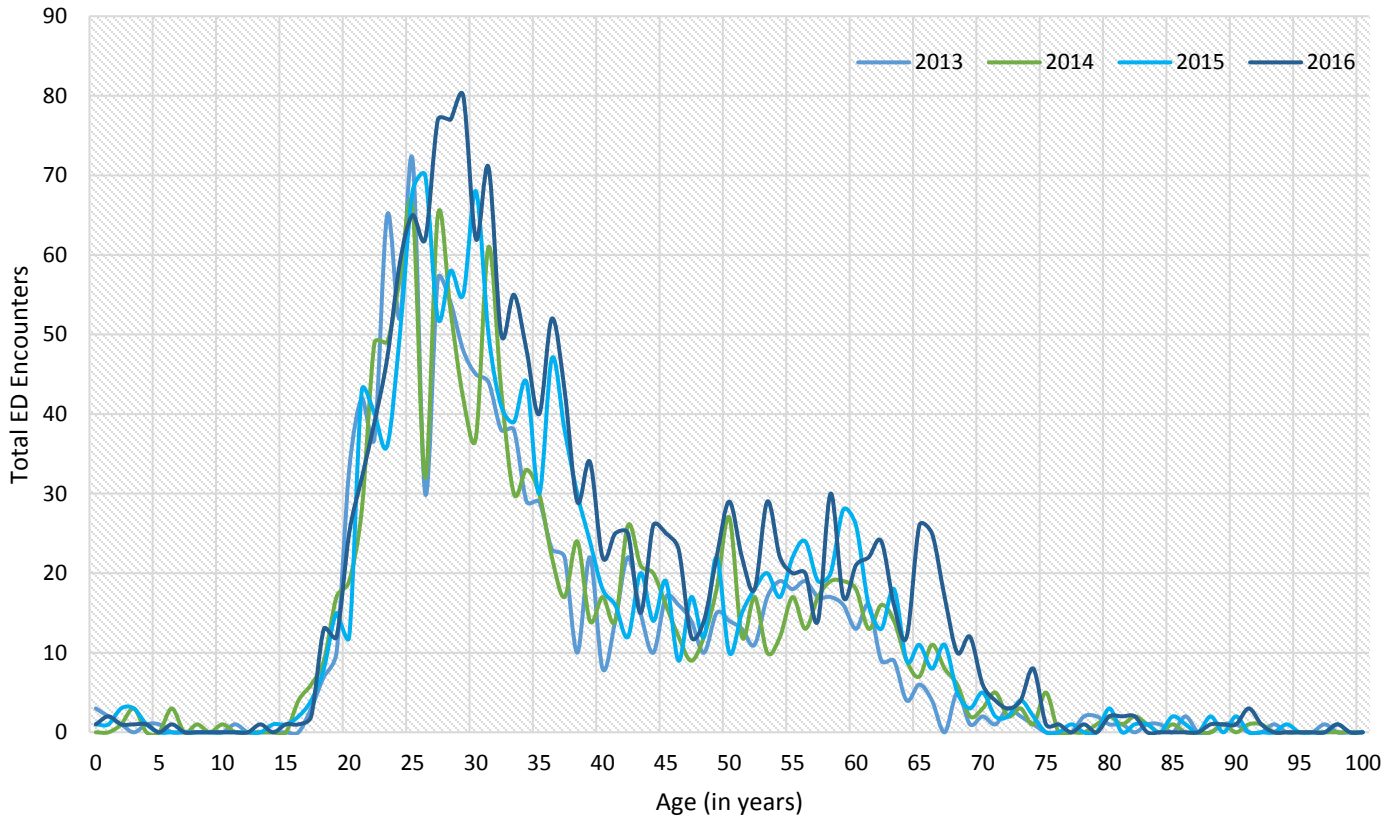
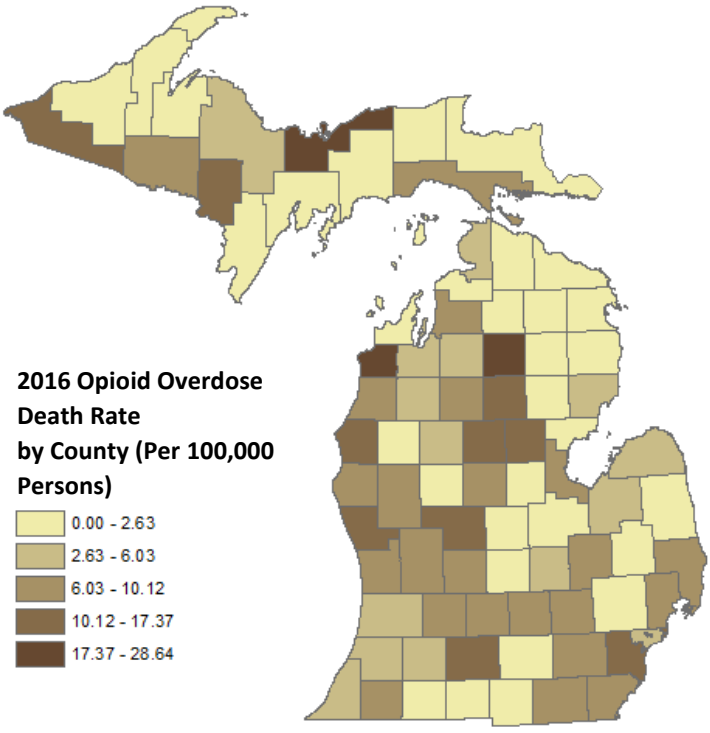


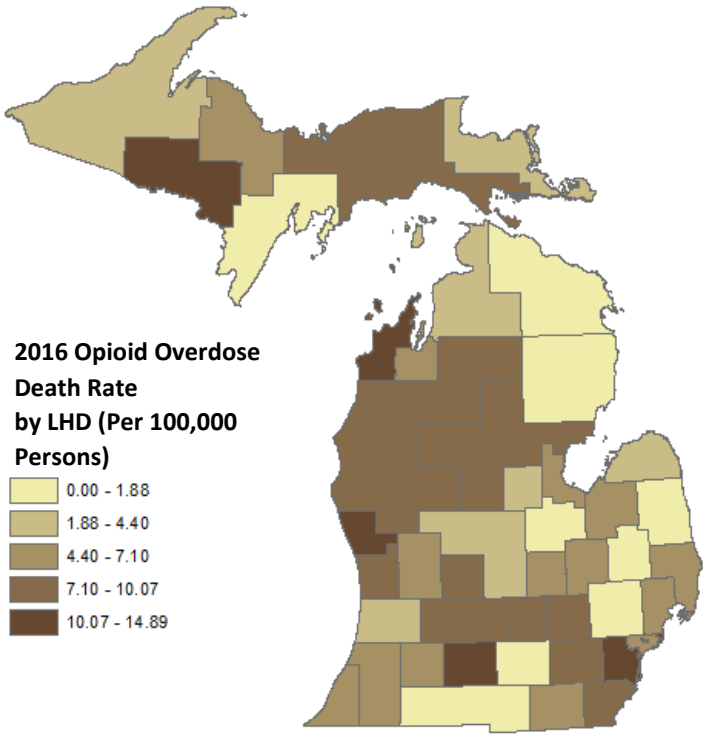
Figure 7.5 Emergency Department Encounters for Substance Abuse, by Age Year, Syndromic Surevillance System, 2013-2016

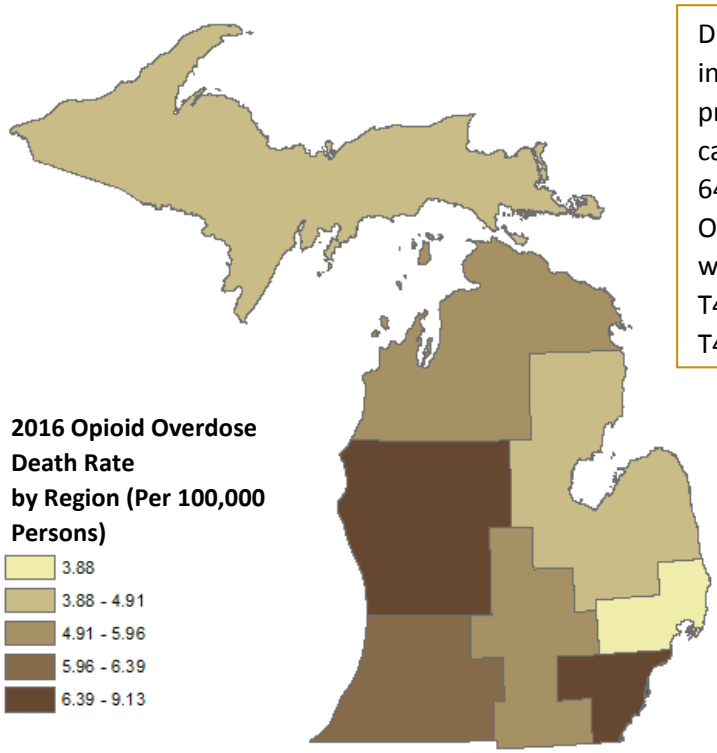


When stratifying by age, the ED encounters related to our query appeared to occur more frequently in the young adult population than other age groups in years 2013 through 2016. This observation is consistent with trends and patterns of injection drug and opioid abuse in Michigan and subsequent risk for viral pathogens like HCV.

Opioid Overdose Death Rate Maps by County, Local Health Jurisdiction, and Region

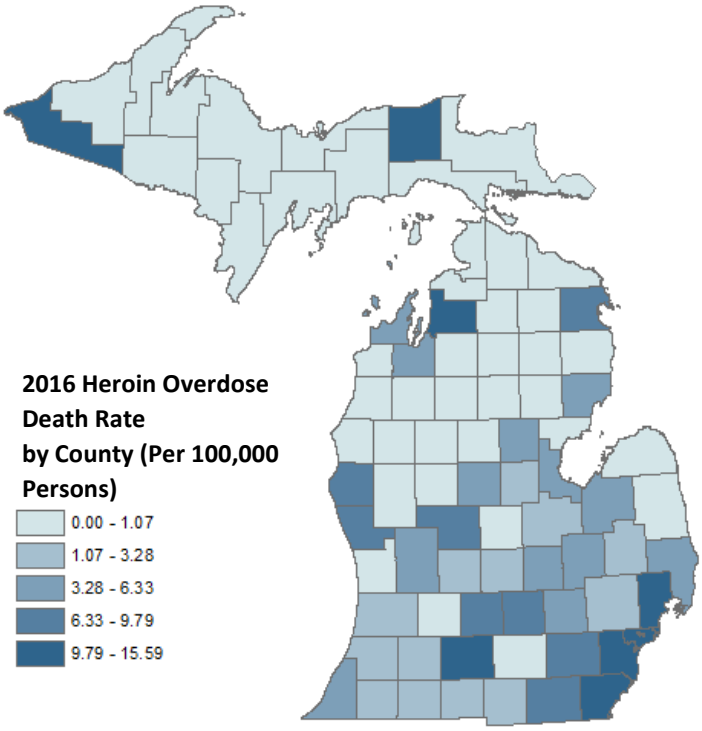


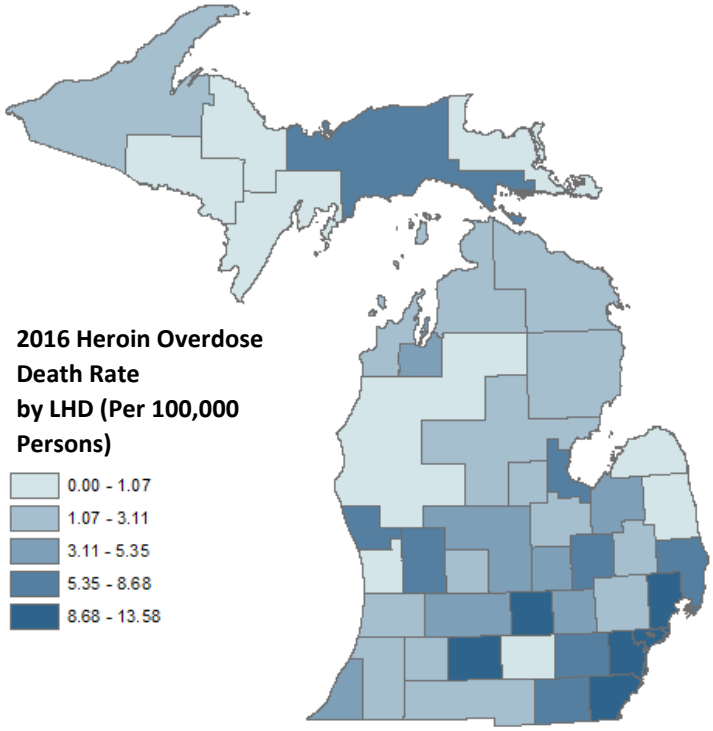


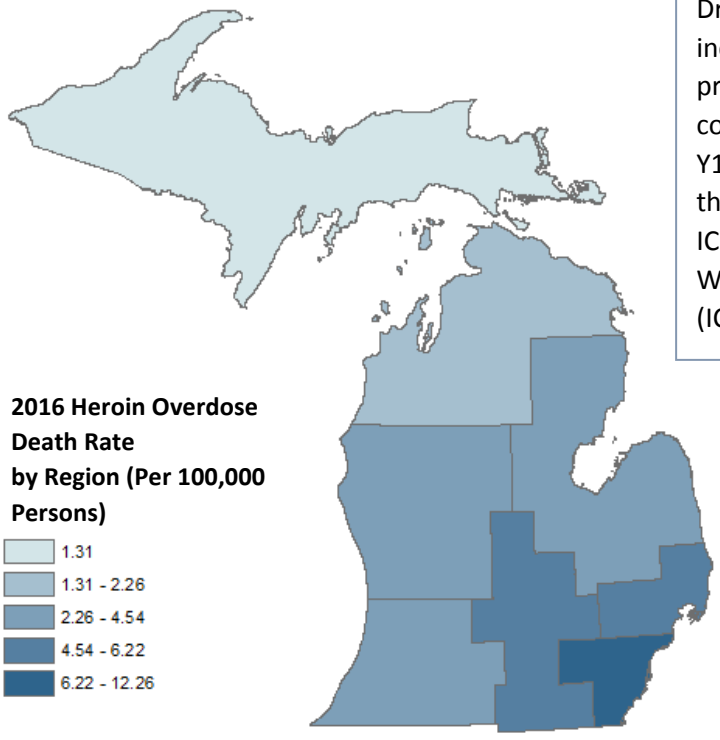


Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. Opioid deaths are those with ICD-10 codes T40.2-T40.4, with no mention of T40.1 (heroin).

Heroin Overdose Death Rate Maps by County, Local Health Jurisdiction, and Region

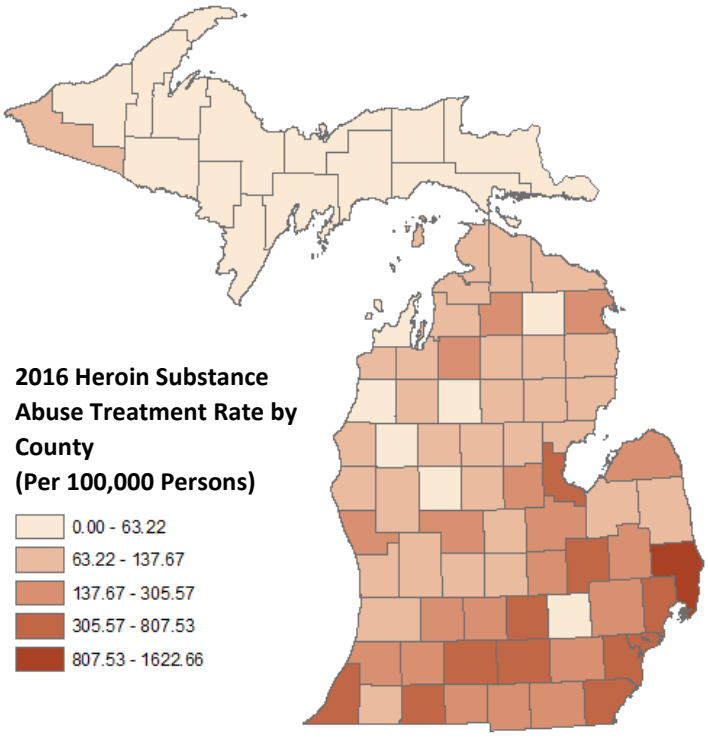


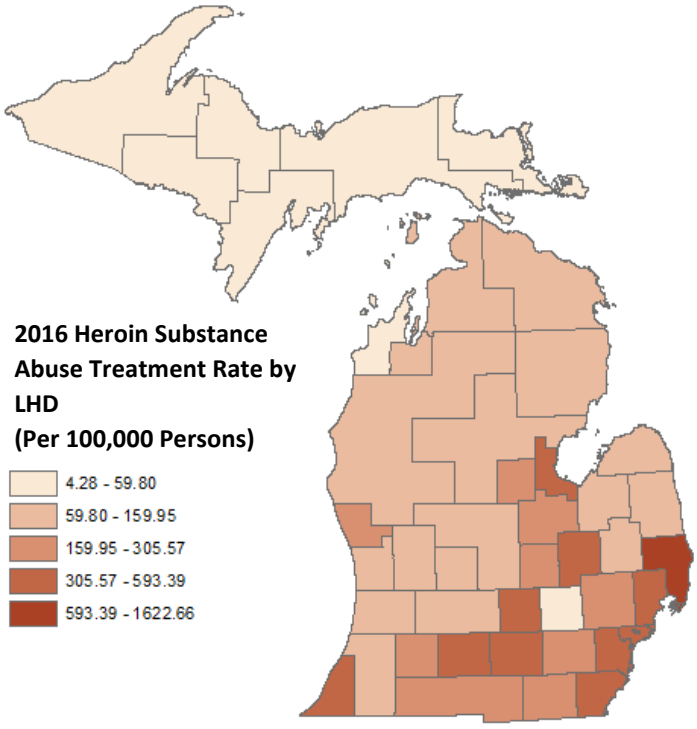


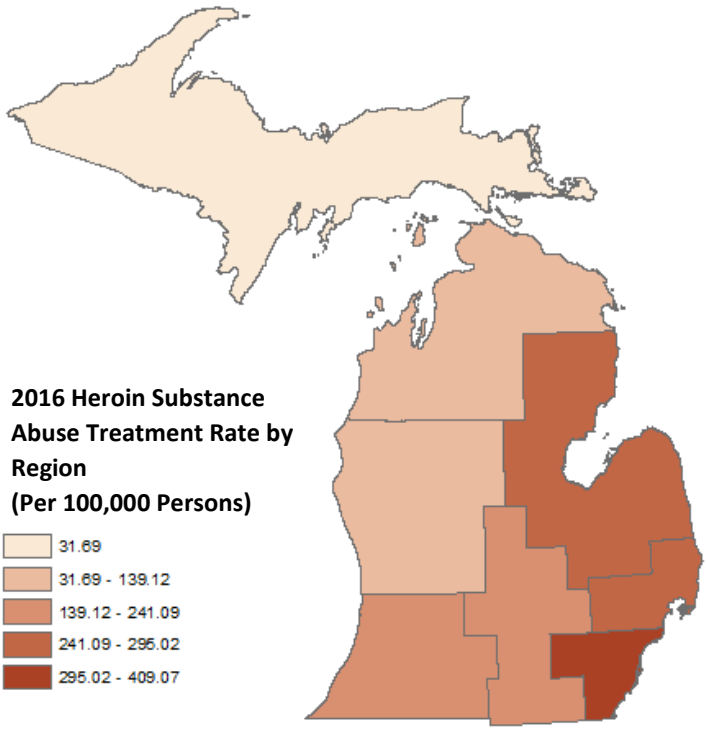


Drug poisoning deaths include those with ICD-10 primary or underlying cause code X40-44, X60-64, X85 and Y10-14. Heroin deaths are those that include a related ICD-19 cause code of T40. With or without other opioids (ICD-10 codes T40.2-T40.4)

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





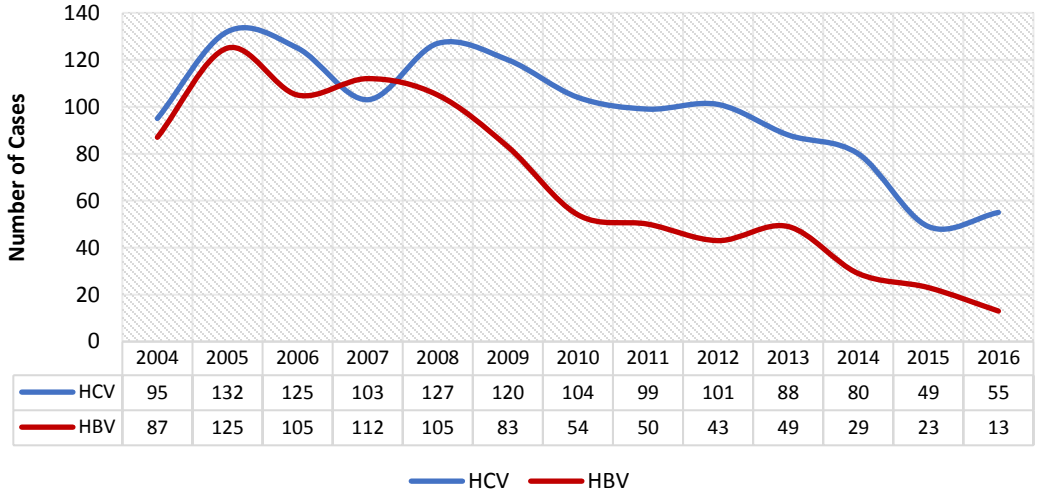


Heroin substance abuse treatment admissions are obtained from the Treatment Episode Dataset (TEDS). A heroin admission is any admission where heroin is self-identified as one of the top five substances responsible for the admission. These numbers represent unique admissions and not unique patients.

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 cross-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.

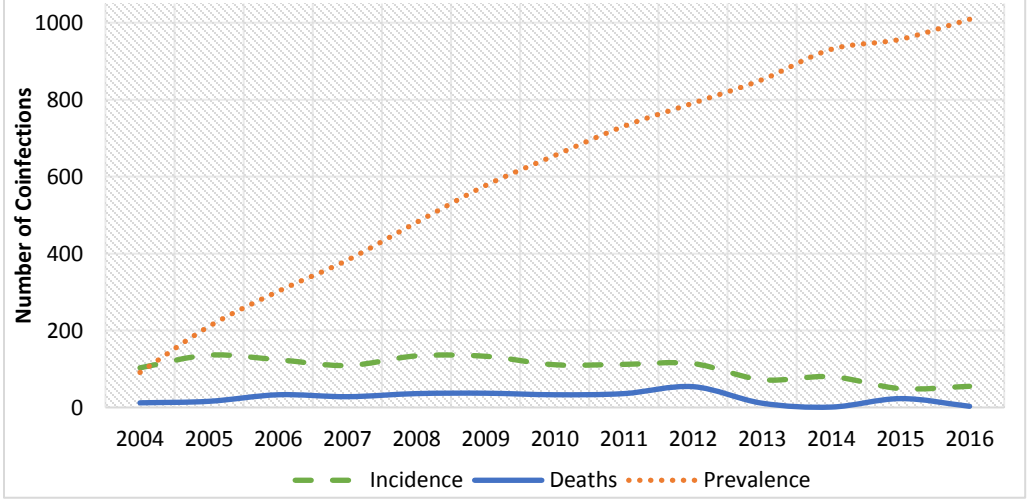
Figure 8.1 Count of Hepatitis B and Hepatitis C Cases Co-infected with HIV in Michigan, 2004-2016



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
HCV	95	132	125	103	127	120	104	99	101	88	80	49	55
HBV	87	125	105	112	105	83	54	50	43	49	29	23	13

In general, the number of new matches for HBV/HIV and HCV/HIV co-infection has trended downward in recent years. However, since most of these individuals are living longer (largely because of improvements in HIV linkage to care and viral suppression) prevalence of both co-infections has increased (Figure 8.2). Tables 8.1 and 8.2 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 8.2 Prevalence of Diagnosed HCV-HIV Coinfections in Michigan, 2004 - 2016



Between 2004 and 2015, 839 people were reported in Michigan with HBV/HIV co-infection. Table 8.1 shows a breakdown of the HBV/HIV co-infected population in 2016. The 2016 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 8.1 Hepatitis B and HIV Co-Infection Data in Michigan, 2016

Variable	2016 HBV/HIV Co-infections		2004-2015 HBV/HIV Co-infections	
Total Co-infections	13		839	
Sex				
Male	12	*(92.3%)*	737	*(87.8%)*
Female	1	*(7.7%)*	102	*(12.2%)*
Unknown	0	*(0.0%)*	0	*(0.0%)*
Race				
Caucasian	2	*(15.4%)*	218	*(26.0%)*
Black or African American	9	*(69.2%)*	557	*(66.4%)*
Hispanic	0	*(0.0%)*	25	*(3.0%)*
Asian	1	*(7.7%)*	0	*(0.0%)*
American Indian or Alaskan Native	0	*(0.0%)*	13	*(1.5%)*
Multi/Other/Unknown	1	*(7.7%)*	26	*(3.1%)*
HIV Transmission Risk				
MSM	7	*(53.8%)*	484	*(57.7%)*
IDU	0	*(0.0%)*	88	*(10.5%)*
MSM/IDU	3	*(23.1%)*	36	*(4.3%)*
Blood Recipient	0	*(0.0%)*	8	*(1.0%)*
Heterosexual	1	*(7.7%)*	37	*(4.4%)*
Perinatal	1	*(7.7%)*	1	*(0.1%)*
Unknown/Undetermined	1	*(7.7%)*	138	*(16.4%)*
Age at Coinfection				
0-19	1	*(7.7%)*	8	*(1.0%)*
20-29	1	*(7.7%)*	105	*(12.5%)*
30-39	2	*(15.4%)*	227	*(27.1%)*
40-49	5	*(38.5%)*	292	*(34.8%)*
50-59	4	*(30.8%)*	156	*(18.6%)*
60+	0	*(0.0%)*	46	*(5.5%)*

Between 2004 and 2015, 1,191 people were reported in Michigan with HIV/HCV co-infection. Table 8.2 shows a breakdown of the HCV/HIV co-infected population in 2016. The 2016 cases are similar to the historical cases in regard to race and sex, but MSM was the predominant risk factor for HCV/HIV co-infection, and the age distribution has shifted slightly toward younger patients. 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 8.2 Hepatitis C and HIV Co-Infection Data in Michigan, 2016

Variable	2016 HCV/HIV Co-infections		2004-2015 HCV/HIV Co-infections	
Total Co-infections	55		1,191	
Sex				
Male	45	*(81.8%)*	845	*(70.9%)*
Female	10	*(18.2%)*	338	*(28.4%)*
Unknown	0	*(0.0%)*	8	*(0.7%)*
Race				
Caucasian	8	*(14.5%)*	335	*(28.1%)*
Black or African American	44	*(80.0%)*	731	*(61.4%)*
Hispanic	1	*(1.8%)*	47	*(3.9%)*
Asian	0	*(0.0%)*	15	*(1.3%)*
American Indian or Alaskan Native	0	*(0.0%)*	2	*(0.2%)*
Multi/Other/Unknown	2	*(3.6%)*	61	*(5.1%)*
HIV Transmission Risk				
MSM	24	*(43.6%)*	223	*(18.7%)*
IDU	19	*(34.5%)*	517	*(43.4%)*
MSM/IDU	5	*(9.1%)*	137	*(11.5%)*
Blood Recipient	0	*(0.0%)*	42	*(3.5%)*
Heterosexual	3	*(5.5%)*	143	*(12.0%)*
Perinatal	0	*(0.0%)*	2	*(0.2%)*
Unknown/Undetermined	4	*(7.3%)*	127	*(10.7%)*
Age at Coinfection				
0-19	0	*(0.0%)*	7	*(0.6%)*
20-29	7	*(12.7%)*	57	*(4.8%)*
30-39	9	*(16.4%)*	149	*(12.5%)*
40-49	8	*(14.5%)*	374	*(31.4%)*
50-59	15	*(27.3%)*	472	*(39.6%)*
60+	16	*(29.1%)*	132	*(11.1%)*

Perinatal Hepatitis B

Hepatitis B infection in a pregnant woman poses inherent risk to the infant at birth, as perinatal transmission is a known risk factor for hepatitis B virus (HBV) infection. CDC estimates that 26,000 babies will be born to hepatitis B surface antigen (HBsAg)-positive women each year, nationwide, with 355 to 553 of those births occurring in MI.

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 recommends vaccination within 24 hours of birth for all medically stable babies, weighing more than 2,000 grams and born to HBsAg-negative women.

The MDHHS Immunization Division Perinatal Hepatitis B Prevention Program (PHBPP)'s mission is to identify HBV infected pregnant women in order to coordinate proper care and treatment of the babies born to them. Since 2010, only three babies born in MI were identified as being perinatally infected with HBV, with no such instances occurring in the most current data year of 2015. In 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.

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. Infants born to HBsAg-positive women should receive hepatitis B immune globulin (HBIG) and hepB vaccine within 12 hours of life with at least two additional doses of hepB vaccine and a post-vaccination serologic test (PVST) at nine to twelve months of age.

Figure 9.1 Case management by MI's Perinatal Hepatitis B Prevention Program (PHBPP), 2012-2015

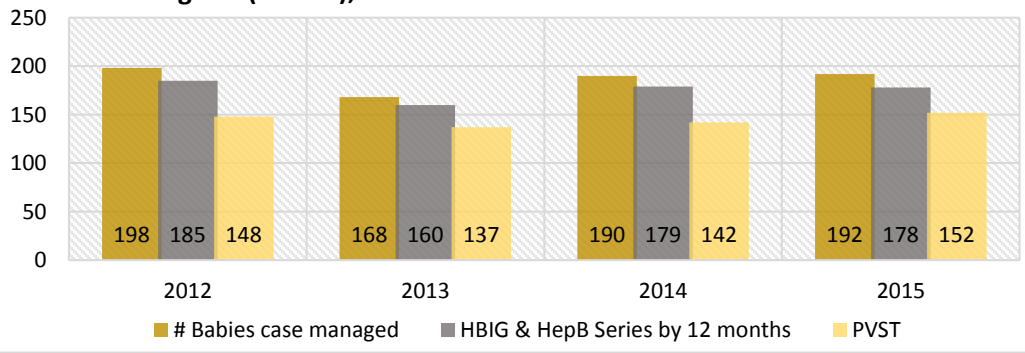


Table 9.1 Proportion of Infants Receiving Post-exposure prophylaxis (PEP) in MI and the US, 2010-2014

	2010		2011		2012		2013		2014	
	MI	US	MI	US	MI	US	MI	US	MI	US
Percent of infants receiving PEP at birth (HBIG & hepB within 1 day)	99%	96%	98%	96%	99%	96%	100%	96%	100%	97%
Percent of infants with HBIG & complete HepB series by 12 Months	93%	84%	90%	84%	93%	84%	95%	84%	94%	82%
Percent of infants with PVST by end of reporting period 1	77%	60%	82%	61%	75%	63%	82%	65%	75%	64%

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.

Perinatal Hepatitis C

It is estimated that perinatal hepatitis C 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 female Baby-Boomers in Michigan (Figure 9.2). 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 hepatitis B. It is not recommended to treat pregnant women for HCV infection. However, HCV direct acting antivirals are not 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 hepatitis C cases in MI in 2014 to be in the range of 15 to 85 cases.

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 20 instances of perinatal HCV reported from 2012 through 2016, which is more than twice the number of perinatal HIV and HBV infections combined. The 20 perinatal HCV cases are likely an underestimation because an estimated 50-75% of the HCV infected population is undiagnosed, there is no prenatal HCV testing recommendation for pregnant women, and infants are often not tested or tested inaccurately.

Figure 9.2 Average number of Hepatitis C Cases per 100,000 Population, Women of Childbearing Age compared to Total Women, 2005-2014

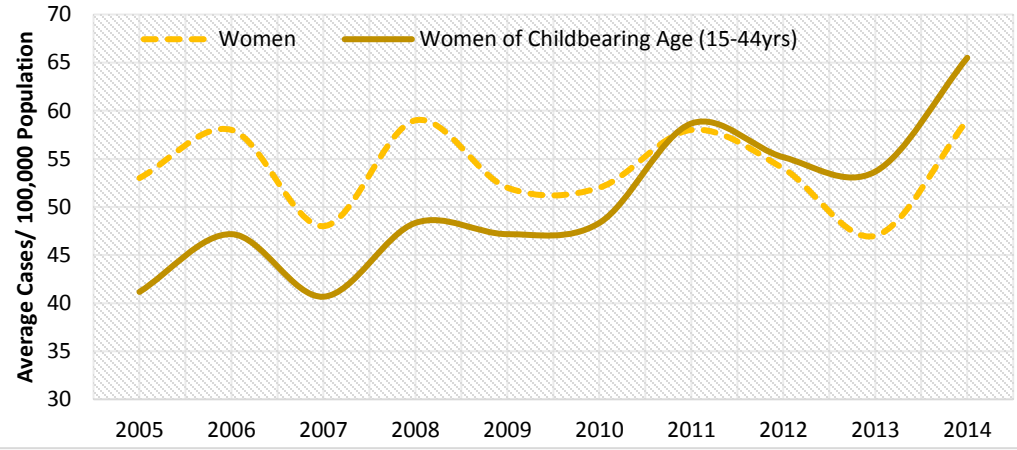
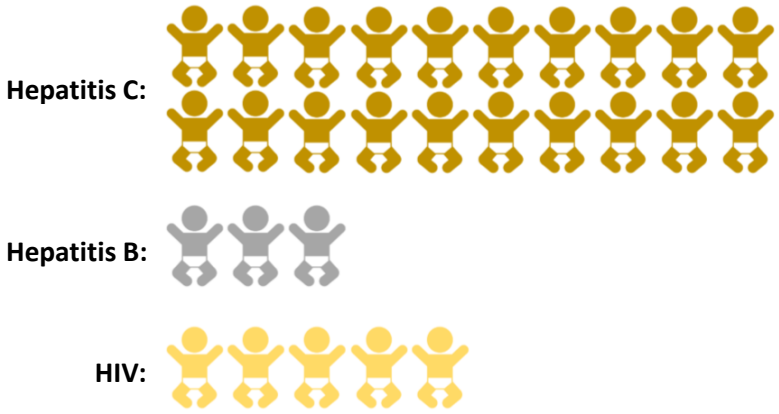
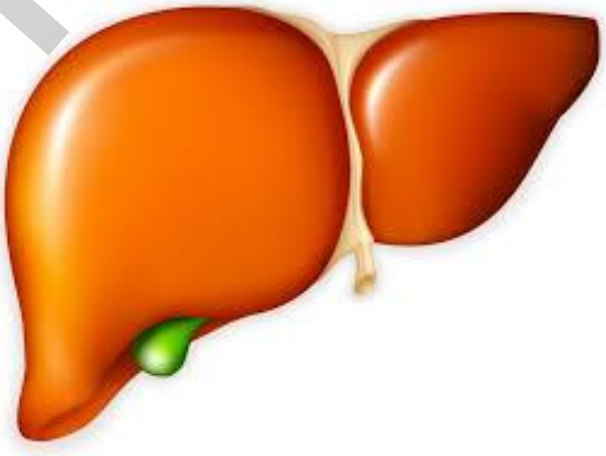


Figure 9.3 Identified Perinatal Infections, MDSS and eHARs, 2012-2016



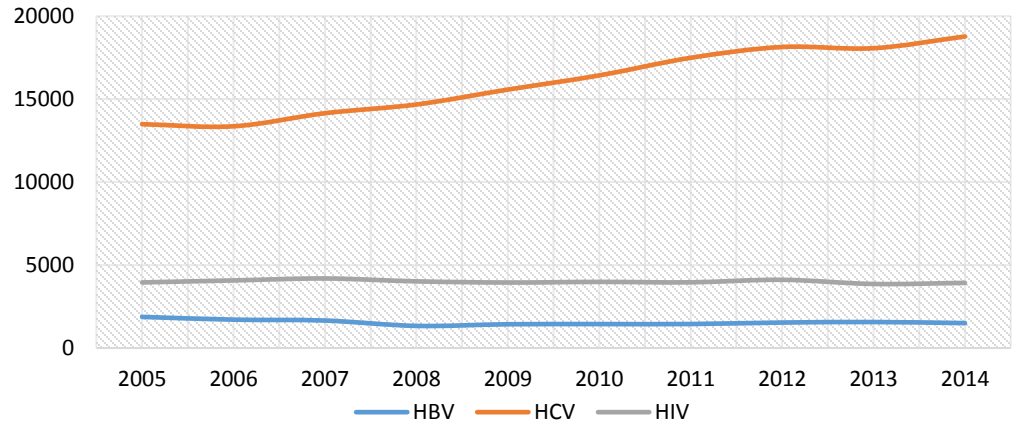
Viral Hepatitis Outcomes



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 hepatitis C. Figure 10.5 indicates that hospitalizations attributed to hepatitis C increased by nearly 40% from 2005 through 2014, while total hospitalizations due to hepatitis B and HIV each decreased slightly.

Figure 10.5 Hospitalizations Due to HBV, HCV and HIV, Michigan, 2005-2014

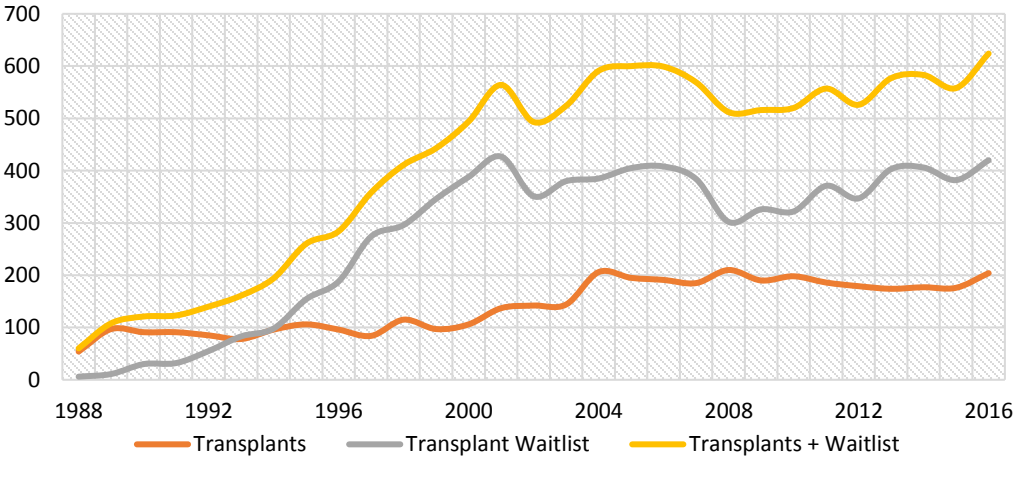


Note: Hospitalizations documenting hepatitis B include inpatient hospitalizations with ICD-9-CM codes for acute, chronic, or unspecified hepatitis B (07020, 07021, 07022, 07023, 07030, 07031, 07032, 07033, or V0261). Hospitalizations documenting hepatitis C include ICD-9-CM codes for acute, chronic, 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 2016 were requested through the United Network of Organ Sharing (UNOS, https://www.unos.org/).

Figure 10.4 Liver Transplants and Transplant Waitlist, Michigan, 1988-2016



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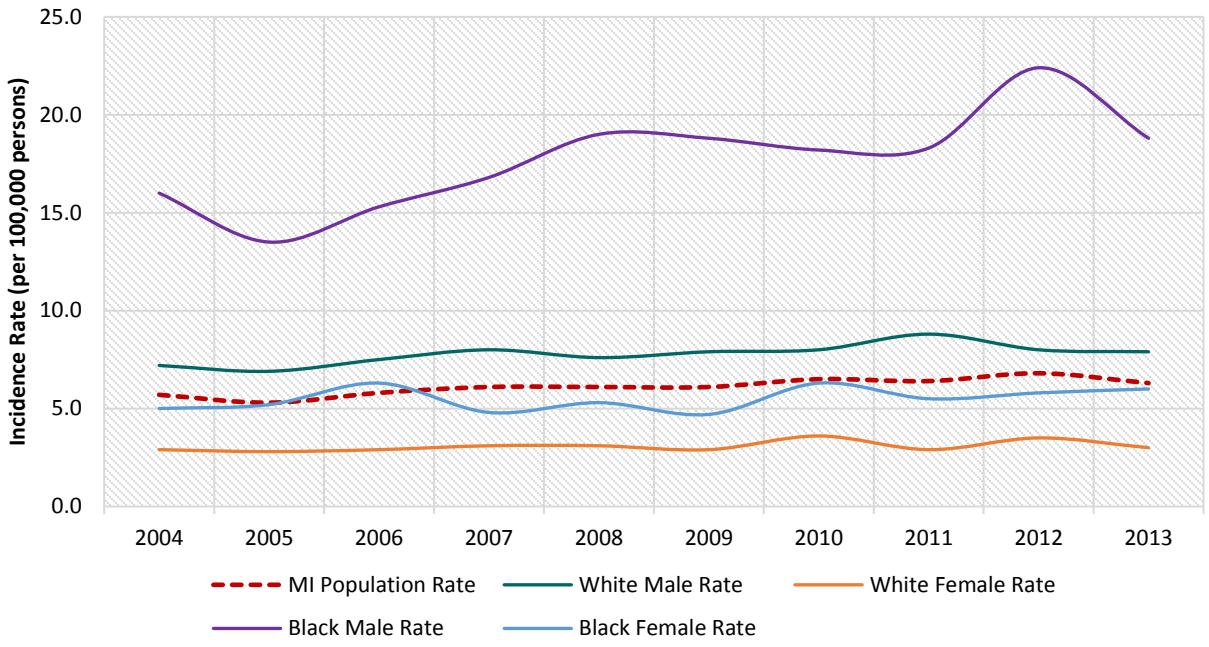
Viral Hepatitis-Related Cancer & Mortality

Figure 10.1 Invasive Cancers of the Liver and Intrahepatic Bile Ducts in Michigan, 2004-2013



Viral hepatitis is a primary risk factor for the development of liver cancer. Figure 10.1 shows the age adjusted rate of liver and intrahepatic bile duct cancer for specific race categories. The number of cases per year of liver and bile duct cancer have increased 33% between 2004 and 2013. Black males experience an incidence rate that is approximately 2.25 times higher, on average, than White males. The incidence rate for Black females tends to be similar to the state average, while White females see 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 10.1 Incidence Rates of Invasive Cancers of the Liver and Intrahepatic Bile Ducts by Age-adjusted Rates of Race and Sex in Michigan, 2004-2013

Year of Diagnosis	Total		White Male		White Female		Black Male		Black 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

Table 10.1 shows the rate of new cases of liver and intrahepatic bile duct cancer per year from 2004 to 2013 in Michigan per 100,000 people. The overall rate of liver and intrahepatic bile duct cancer in Michigan was 6.3 per 100,000 in 2013. Black males have an incidence rate of 18.8 per 100,000, which is 138% higher than that of White males (7.9 per 100,000). The incidence rate in Black females (6.0) was twice that of White females (3.0) in 2013.

Figure 10.2 Mortality Due to Invasive Cancer of the Liver and Intrahepatic Bile Ducts and Age-Adjusted Death Rates by Race and Sex in Michigan, 2004 - 2014

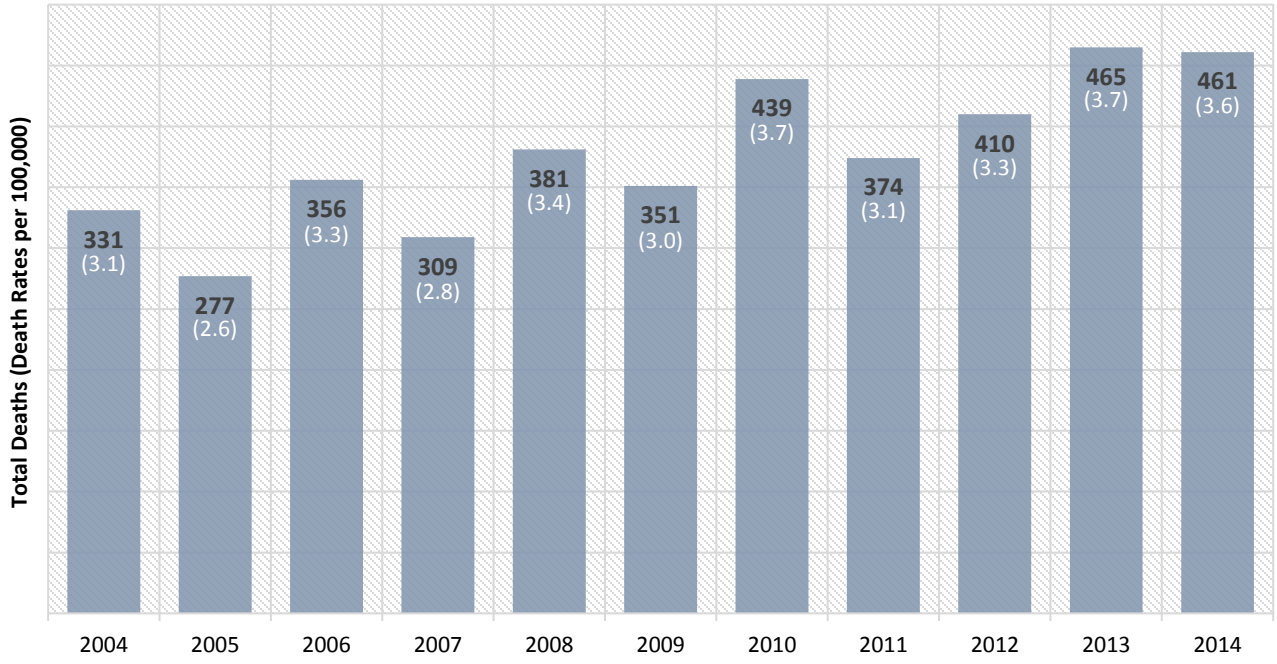


Figure 10.2 shows the number of deaths per year due to liver and intrahepatic bile duct cancer. This total has risen 39% from 2004 to 2014. Chronic infection with viral hepatitis, over time, can lead to liver cancer. As rates of liver cancer increase, we have observed a subsequent increase in mortality associated with liver cancer. Improved efforts to test and treat viral hepatitis infections may help reverse these trends.

Table 10.2 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 - 2014

Year of Death	Total		White Male		White Female		Black Male		Black Female	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
2004	331	3.1	158	3.8	100	2.0	37	6.6	13	*
2005	277	2.6	139	3.3	76	1.5	39	7.0	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	6.0	16	*
2009	351	3.0	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	2.0	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

Table 10.2 shows the death rate per 100,000 Michigan population due to cancer of the liver and intrahepatic bile ducts between 2004 and 2014. The liver and intrahepatic bile duct cancer mortality rate in Michigan in 2014 was 3.6 per 100,000. Black males show the highest death rates due to these cancers as rates have increased by 35% between 2004 and 2014. The death rate in Black males (8.9 per 100,000) is 102% higher than the rate in White males (4.4 per 100,000). The death rate in White males has increased by 16% during between 2004 and 2014 while the death rate in White females has increased by only 5%.

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 o disparities seen in viral hepatitis infection.

Figure 10.3 Deaths Due to Acute and Chronic Hepatitis C, Michigan, 2005-2014

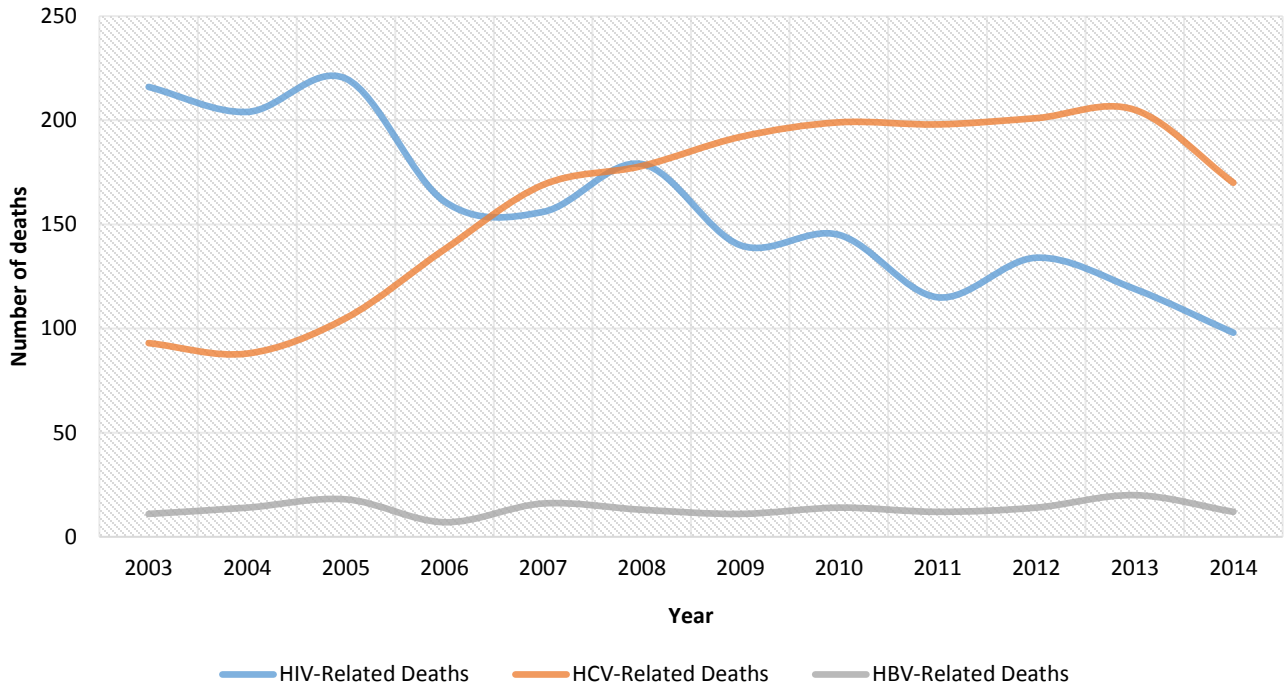


Figure 10.3 shows the number of deaths per year in Michigan residents between 2005 and 2014 due to acute chronic hepatitis C, according to death certificate data, in comparison to hepatitis B and HIV. The Vital Records and Health Statistics Section provides data on underlying causes of death in Michigan, which is classified using the Tenth Revision of the International Classification of Diseases (ICD-10).

In 2014 there were 170 deaths attributed to hepatitis C in Michigan (ICD-10: B17.1, B18.2, B19.2). Between 2005 and 2014, deaths due to chronic hepatitis C increased by 62%. The number of deaths decreased between 2013 and 2014, perhaps due to the introduction of new medications that treat hepatitis C. In the same timeframe, hepatitis B deaths (ICD-10: B16.2, B16.9, B18.1) decreased from 18 to 12 while HIV related deaths (ICD-10: B20-B24) were reduced by approximately 25%.

Appendices

Appendix A1: County Hepatitis Data

County	Total Population	2016 Chronic HCV Cases	2016 Acute HCV Cases	2016 Chronic HBV Cases	2016 Acute HBV Cases	2016 Chronic HCV Rate*	2016 Acute HCV Rate*	2016 Chronic HBV Rate*	2015 Acute HBV Rate*
Alcona	10,349	6	0	0	0	57.98	0.00	0.00	0.00
Alger	9,383	4	2	0	0	42.63	21.32	0.00	0.00
Allegan	114,625	57	1	1	0	49.73	0.87	0.87	0.00
Alpena	28,803	21	0	1	0	72.91	0.00	3.47	0.00
Antrim	23,154	26	2	1	0	112.29	8.64	4.32	0.00
Arenac	15,261	13	0	0	0	85.18	0.00	0.00	0.00
Baraga	8,575	14	0	2	0	163.27	0.00	23.32	0.00
Barry	59,314	40	2	5	0	67.44	3.37	8.43	0.00
Bay	105,659	132	1	4	0	124.93	0.95	3.79	0.00
Benzie	17,457	8	1	2	0	45.83	5.73	11.46	0.00
Berrien	154,636	133	8	7	0	86.01	5.17	4.53	0.00
Branch	43,664	40	0	3	0	91.61	0.00	6.87	0.00
Calhoun	134,314	141	5	18	1	104.98	3.72	13.40	0.74
Cass	51,657	40	1	4	0	77.43	1.94	7.74	0.00
Charlevoix	26,238	13	0	0	0	49.55	0.00	0.00	0.00
Cheboygan	25,427	24	0	2	0	94.39	0.00	7.87	0.00
Chippewa	38,033	55	1	6	0	144.61	2.63	15.78	0.00
Clare	30,553	51	0	0	0	166.92	0.00	0.00	0.00
Clinton	77,390	25	0	4	0	32.30	0.00	5.17	0.00
Crawford	13,801	11	0	1	0	79.70	0.00	7.25	0.00
Delta	36,377	48	2	7	2	131.95	5.50	19.24	5.50
Detroit City	677,116	2,496	7	240	4	368.62	1.03	35.44	0.59
Dickinson	25,788	37	0	0	0	143.48	0.00	0.00	0.00
Eaton	108,801	82	1	4	0	75.37	0.92	3.68	0.00
Emmet	33,161	33	0	2	0	99.51	0.00	6.03	0.00
Genesee	410,849	624	4	50	2	151.88	0.97	12.17	0.49
Gladwin	25,164	32	0	0	0	127.17	0.00	0.00	0.00
Gogebic	15,431	12	3	0	0	77.77	19.44	0.00	0.00
Grand Traverse	91,636	58	6	3	1	63.29	6.55	3.27	1.09
Gratiot	41,540	20	0	2	0	48.15	0.00	4.81	0.00
Hillsdale	45,941	43	0	3	0	93.60	0.00	6.53	0.00
Houghton	36,380	24	2	1	0	65.97	5.50	2.75	0.00
Huron	31,883	23	0	1	0	72.14	0.00	3.14	0.00
Ingham	286,085	258	5	55	0	90.18	1.75	19.23	0.00
Ionia	64,223	44	0	1	0	68.51	0.00	1.56	0.00
Iosco	25,345	33	0	3	1	130.20	0.00	11.84	3.95
Iron	11,348	31	0	0	0	273.18	0.00	0.00	0.00
Isabella	70,698	20	0	3	0	28.29	0.00	4.24	0.00
Jackson	159,494	141	2	3	0	88.40	1.25	1.88	0.00
Kalamazoo	260,263	193	2	11	0	74.16	0.77	4.23	0.00
Kalkaska	17,260	4	0	1	0	23.17	0.00	5.79	0.00
Kent	636,369	391	0	100	1	61.44	0.00	15.71	0.16
Keweenaw	2,168	1	0	0	0	46.13	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	2016 Chronic HCV Cases	2016 Acute HCV Cases	2016 Chronic HBV Cases	2016 Acute HBV Cases	2016 Chronic HCV Rate*	2016 Acute HCV Rate*	2016 Chronic HBV Rate*	2015 Acute HBV Rate*
Lake	11,424	10	0	0	0	87.54	0.00	0.00	0.00
Lapeer	88,373	57	4	2	0	64.50	4.53	2.26	0.00
Leelanau	21,981	8	0	0	0	36.40	0.00	0.00	0.00
Lenawee	98,573	86	0	8	1	87.24	0.00	8.12	1.01
Livingston	187,316	91	2	14	1	48.58	1.07	7.47	0.53
Luce	6,415	11	0	0	0	171.47	0.00	0.00	0.00
Mackinac	10,890	12	0	0	0	110.19	0.00	0.00	0.00
Macomb	864,840	944	31	112	9	109.15	3.58	12.95	1.04
Manistee	24,461	38	0	1	1	155.35	0.00	4.09	4.09
Marquette	67,215	71	0	2	1	105.63	0.00	2.98	1.49
Mason	28,783	9	0	1	0	31.27	0.00	3.47	0.00
Mecosta	43,067	18	1	1	0	41.80	2.32	2.32	0.00
Menominee	23,548	28	0	1	1	118.91	0.00	4.25	4.25
Midland	83,632	37	5	9	0	44.24	5.98	10.76	0.00
Missaukee	14,903	11	1	0	0	73.81	6.71	0.00	0.00
Monroe	149,568	248	0	17	0	165.81	0.00	11.37	0.00
Montcalm	62,945	55	3	2	0	87.38	4.77	3.18	0.00
Montmorency	9,259	10	0	0	0	108.00	0.00	0.00	0.00
Muskegon	172,790	150	5	9	0	86.81	2.89	5.21	0.00
Newaygo	47,948	25	0	1	0	52.14	0.00	2.09	0.00
Oakland	1,242,304	1,039	10	181	2	83.63	0.80	14.57	0.16
Oceana	26,105	15	0	0	0	57.46	0.00	0.00	0.00
Ogemaw	20,937	21	0	0	0	100.30	0.00	0.00	0.00
Ontonagon	6,007	9	0	0	0	149.83	0.00	0.00	0.00
Osceola	23,058	17	0	2	0	73.73	0.00	8.67	0.00
Oscoda	8,251	9	2	1	0	109.08	24.24	12.12	0.00
Otsego	24,253	15	0	1	0	61.85	0.00	4.12	0.00
Ottawa	279,955	113	2	19	2	40.36	0.71	6.79	0.71
Presque Isle	12,841	4	0	0	0	31.15	0.00	0.00	0.00
Roscommon	23,898	33	1	2	0	138.09	4.18	8.37	0.00
Saginaw	193,307	200	2	26	0	103.46	1.03	13.45	0.00
St Clair	159,875	202	11	14	1	126.35	6.88	8.76	0.63
St Joseph	61,018	49	0	4	0	80.30	0.00	6.56	0.00
Sanilac	41,475	27	1	3	0	65.10	2.41	7.23	0.00
Schoolcraft	8,173	8	3	0	0	97.88	36.71	0.00	0.00
Shiawassee	68,619	50	1	3	0	72.87	1.46	4.37	0.00
Tuscola	53,777	28	2	7	0	52.07	3.72	13.02	0.00
Van Buren	75,077	64	1	1	0	85.25	1.33	1.33	0.00
Washtenaw	358,880	209	3	47	2	58.24	0.84	13.10	0.56
Wayne	1,082,215	1,604	3	211	12	148.21	0.28	19.50	1.11
Wexford	33,003	37	0	1	1	112.11	0.00	3.03	3.03
MDOC	43,359	704	2	29	0	1,623.65	4.61	66.88	0.00
State-wide†	9,922,572	11,883	154	1,284	46	119.76	1.55	12.94	0.46

*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	2016 Young Adult (18-29) HCV Cases	2016 Heroin Treatment Admissions	2015 Heroin Overdose Deaths	2016 Young Adult (18-29) HCV Rate*	2016 Heroin Treatment Admission Rate*	2015 Heroin Overdose Death Rate*
Alcona	10,349	855	1	8	0	116.96	77.30	0.00
Alger	9,383	1,143	1	1	0	87.49	10.66	0.00
Allegan	114,625	15,630	7	94	3	44.79	82.01	2.62
Alpena	28,803	3,520	9	53	2	255.68	184.01	6.94
Antrim	23,154	2,440	9	21	3	368.85	90.70	12.96
Arenac	15,261	1,751	5	16	0	285.55	104.84	0.00
Baraga	8,575	1,207	7	4	0	579.95	46.65	0.00
Barry	59,314	7,822	3	88	0	38.35	148.36	0.00
Bay	105,659	15,026	44	409	6	292.83	387.09	5.68
Benzie	17,457	1,940	2	14	0	103.09	80.20	0.00
Berrien	154,636	22,139	22	593	7	99.37	383.48	4.53
Branch	43,664	5,946	13	66	1	218.63	151.15	2.29
Calhoun	134,314	20,222	34	461	18	168.13	343.23	13.40
Cass	51,657	6,634	5	53	1	75.37	102.60	1.94
Charlevoix	26,238	3,072	3	34	0	97.66	129.58	0.00
Cheboygan	25,427	2,787	5	19	0	179.40	74.72	0.00
Chippewa	38,033	6,985	18	12	0	257.70	31.55	0.00
Clare	30,553	3,843	12	41	0	312.26	134.19	0.00
Clinton	77,390	11,347	9	87	2	79.32	112.42	2.58
Crawford	13,801	1,502	1	19	0	66.58	137.67	0.00
Delta	36,377	4,264	17	23	0	398.69	63.23	0.00
Detroit City	677,116	119,595	140	4,018	87	117.06	593.40	12.85
Dickinson	25,788	3,158	9	7	0	284.99	27.14	0.00
Eaton	108,801	16,667	21	178	9	126.00	163.60	8.27
Emmet	33,161	4,428	16	28	0	361.34	84.44	0.00
Genesee	410,849	61,514	113	1,619	26	183.70	394.06	6.33
Gladwin	25,164	2,766	6	23	1	216.92	91.40	3.97
Gogebic	15,431	2,164	4	18	2	184.84	116.65	12.96
Grand Traverse	91,636	13,044	14	87	4	107.33	94.94	4.37
Gratiot	41,540	7,297	4	43	0	54.82	103.51	0.00
Hillsdale	45,941	6,856	14	91	1	204.20	198.08	2.18
Houghton	36,380	9,741	8	19	0	82.13	52.23	0.00
Huron	31,883	3,706	5	51	0	134.92	159.96	0.00
Ingham	286,085	77,788	43	935	28	55.28	326.83	9.79
Ionia	64,223	10,370	4	75	2	38.57	116.78	3.11
Iosco	25,345	2,706	6	22	1	221.73	86.80	3.95
Iron	11,348	1,100	11	3	0	1,000.00	26.44	0.00
Isabella	70,698	25,663	7	83	4	27.28	117.40	5.66
Jackson	159,494	24,512	41	585	1	167.27	366.78	0.63
Kalamazoo	260,263	59,224	57	629	5	96.24	241.68	1.92
Kalkaska	17,260	2,111	0	33	0	0.00	191.19	0.00
Kent	636,369	112,959	54	818	36	47.80	128.54	5.66
Keweenaw	2,168	193	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	2016 Young Adult (18-29) HCV Cases	2016 Heroin Treatment Admissions	2015 Heroin Overdose Deaths	2016 Young Adult (18-29) HCV Rate*	2016 Heroin Treatment Admission Rate*	2015 Heroin Overdose Death Rate*
Lake	11,424	1,089	0	3	0	0.00	26.26	0.00
Lapeer	88,373	11,878	13	134	2	109.45	151.63	2.26
Leelanau	21,981	2,367	0	2	1	0.00	9.10	4.55
Lenawee	98,573	14,785	16	196	7	108.22	198.84	7.10
Livingston	187,316	24,673	20	112	7	81.06	59.79	3.74
Luce	6,415	873	7	0	1	801.83	0.00	15.59
Mackinac	10,890	1,148	1	5	0	87.11	45.91	0.00
Macomb	864,840	129,505	184	3,502	109	142.08	404.93	12.60
Manistee	24,461	3,089	9	12	0	291.36	49.06	0.00
Marquette	67,215	14,553	18	40	0	123.69	59.51	0.00
Mason	28,783	3,601	0	29	0	0.00	100.75	0.00
Mecosta	43,067	10,942	0	26	0	0.00	60.37	0.00
Menominee	23,548	2,759	10	11	0	362.45	46.71	0.00
Midland	83,632	12,627	9	231	2	71.28	276.21	2.39
Missaukee	14,903	1,937	5	1	0	258.13	6.71	0.00
Monroe	149,568	20,749	62	563	18	298.81	376.42	12.03
Montcalm	62,945	8,815	3	92	6	34.03	146.16	9.53
Montmorency	9,259	806	2	4	0	248.14	43.20	0.00
Muskegon	172,790	26,095	32	528	15	122.63	305.57	8.68
Newaygo	47,948	6,471	7	52	0	108.17	108.45	0.00
Oakland	1,242,304	179,186	154	2,164	22	85.94	174.19	1.77
Oceana	26,105	3,338	0	24	2	0.00	91.94	7.66
Ogemaw	20,937	2,379	4	18	0	168.14	85.97	0.00
Ontonagon	6,007	416	2	0	0	480.77	0.00	0.00
Osceola	23,058	2,916	5	19	0	171.47	82.40	0.00
Oscoda	8,251	913	4	6	0	438.12	72.72	0.00
Otsego	24,253	3,226	7	47	0	216.99	193.79	0.00
Ottawa	279,955	54,302	16	294	3	29.46	105.02	1.07
Presque Isle	12,841	1,177	1	9	0	84.96	70.09	0.00
Roscommon	23,898	2,271	4	19	0	176.13	79.50	0.00
Saginaw	193,307	31,620	42	441	3	132.83	228.13	1.55
St Clair	159,875	21,755	50	673	10	229.83	420.95	6.25
St Joseph	61,018	8,501	1	66	2	11.76	108.16	3.28
Sanilac	41,475	5,139	4	56	0	77.84	135.02	0.00
Schoolcraft	8,173	876	3	2	1	342.47	24.47	12.24
Shiawassee	68,619	9,762	4	128	3	40.98	186.54	4.37
Tuscola	53,777	7,215	5	51	2	69.30	94.84	3.72
Van Buren	75,077	9,872	7	124	2	70.91	165.16	2.66
Washtenaw	358,880	92,722	29	661	26	31.28	184.18	7.24
Wayne	1,082,215	170,201	264	4,035	147	155.11	372.85	13.58
Wexford	33,003	4,411	15	39	0	340.06	118.17	0.00
MDOC	43,359	8,299	236	-	-	2,843.72	-	-
State-wide†	9,922,572	1,618,597	2,060	25,910	644	127.27	261.12	6.49

*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	2016 Chronic HCV Cases	2016 Acute HCV Cases	2016 Chronic HBV Cases	2016 Acute HBV Cases	2016 Chronic HCV Rate*	2016 Acute HCV Rate*	2016 Chronic HBV Rate*	2015 Acute HBV Rate*
Allegan	114,625	57	1	1	0	49.73	0.87	0.87	0.00
Barry-Eaton	168,115	122	3	9	0	72.57	1.78	5.35	0.00
Bay	105,659	132	1	4	0	124.93	0.95	3.79	0.00
Benzie-Leelanau	39,438	16	1	2	0	40.57	2.54	5.07	0.00
Berrien	154,636	133	8	7	0	86.01	5.17	4.53	0.00
Branch-Hillsdale-St. Joseph	150,623	132	0	10	0	87.64	0.00	6.64	0.00
Calhoun	134,314	141	5	18	1	104.98	3.72	13.40	0.74
Central Michigan	188,632	166	1	7	0	88.00	0.53	3.71	0.00
Chippewa	38,033	55	1	6	0	144.61	2.63	15.78	0.00
Delta-Menominee	59,925	76	2	8	3	126.83	3.34	13.35	5.01
Detroit City	677,116	2,496	7	240	4	368.62	1.03	35.44	0.59
Dickinson-Iron	37,136	68	0	0	0	183.11	0.00	0.00	0.00
District Health Department #10	260,755	178	2	7	2	68.26	0.77	2.68	0.77
District Health Department #2	64,882	69	2	4	1	106.35	3.08	6.17	1.54
District Health Department #4	76,330	59	0	3	0	77.30	0.00	3.93	0.00
Genesee	410,849	624	4	50	2	151.88	0.97	12.17	0.49
Grand Traverse	91,636	58	6	3	1	63.29	6.55	3.27	1.09
Huron	31,883	23	0	1	0	72.14	0.00	3.14	0.00
Ingham	286,085	258	5	55	0	90.18	1.75	19.23	0.00
Ionia	64,223	44	0	1	0	68.51	0.00	1.56	0.00
Jackson	159,494	141	2	3	0	88.40	1.25	1.88	0.00
Kalamazoo	260,263	193	2	11	0	74.16	0.77	4.23	0.00
Kent	636,369	391	0	100	1	61.44	0.00	15.71	0.16
Lapeer	88,373	57	4	2	0	64.50	4.53	2.26	0.00
Lenawee	98,573	86	0	8	1	87.24	0.00	8.12	1.01
Livingston	187,316	91	2	14	1	48.58	1.07	7.47	0.53
Luce-Mackinac-Alger-Schoolcraft	34,861	35	5	0	0	100.40	14.34	0.00	0.00
Macomb	864,840	944	31	112	9	109.15	3.58	12.95	1.04
Marquette	67,215	71	0	2	1	105.63	0.00	2.98	1.49
Midland	83,632	37	5	9	0	44.24	5.98	10.76	0.00
Mid-Michigan	181,875	100	3	8	0	54.98	1.65	4.40	0.00
Monroe	149,568	248	0	17	0	165.81	0.00	11.37	0.00
Muskegon	172,790	150	5	9	0	86.81	2.89	5.21	0.00
Northwest Michigan	106,806	87	2	4	0	81.46	1.87	3.75	0.00
Oakland	1,242,304	1,039	10	181	2	83.63	0.80	14.57	0.16
Ottawa	279,955	113	2	19	2	40.36	0.71	6.79	0.71
Saginaw	193,307	200	2	26	0	103.46	1.03	13.45	0.00
Sanilac	41,475	27	1	3	0	65.10	2.41	7.23	0.00
Shiawassee	68,619	50	1	3	0	72.87	1.46	4.37	0.00
St Clair	159,875	202	11	14	1	126.35	6.88	8.76	0.63
Tuscola	53,777	28	2	7	0	52.07	3.72	13.02	0.00
Van Buren-Cass	126,734	104	2	5	0	82.06	1.58	3.95	0.00
Washtenaw	358,880	209	3	47	2	58.24	0.84	13.10	0.56
Wayne	1,082,215	1,604	3	211	12	148.21	0.28	19.50	1.11
Western Upper Peninsula	68,561	60	5	3	0	87.51	7.29	4.38	0.00
MDOC	43,359	704	2	29	0	1,623.65	4.61	66.88	0.00
Statewide†	9,922,572	11,883	154	1,284	46	119.76	1.55	12.94	0.46

*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	2016 Young Adult (18-29) HCV Cases	2016 Heroin Treatment Admissions	2015 Heroin Overdose Deaths	2016 Young Adult (18-29) HCV Rate*	2016 Heroin Treatment Admission Rate*	2015 Heroin Overdose Death Rate*
Allegan	114,625	15,630	7	94	3	44.79	82.01	2.62
Barry-Eaton	168,115	24,489	24	266	9	98.00	158.23	5.35
Bay	105,659	15,026	44	409	6	292.83	387.09	5.68
Benzie-Leelanau	39,438	4,307	2	16	1	46.44	40.57	2.54
Berrien	154,636	22,139	22	593	7	99.37	383.48	4.53
Branch-Hillsdale-St. Joseph	150,623	21,303	28	223	4	131.44	148.05	2.66
Calhoun	134,314	20,222	34	461	18	168.13	343.23	13.40
Central Michigan	188,632	39,210	39	201	5	99.46	106.56	2.65
Chippewa	38,033	6,985	18	12	0	257.70	31.55	0.00
Delta-Menominee	59,925	7,023	27	34	0	384.45	56.74	0.00
Detroit City	677,116	119,595	140	4,018	87	117.06	593.40	12.85
Dickinson-Iron	37,136	4,258	20	10	0	469.70	26.93	0.00
District Health Department #10	260,755	38,491	37	238	2	96.13	91.27	0.77
District Health Department #2	64,882	6,853	15	54	1	218.88	83.23	1.54
District Health Department #4	76,330	8,290	17	85	2	205.07	111.36	2.62
Genesee	410,849	61,514	113	1,619	26	183.70	394.06	6.33
Grand Traverse	91,636	13,044	14	87	4	107.33	94.94	4.37
Huron	31,883	3,706	5	51	0	134.92	159.96	0.00
Ingham	286,085	77,788	43	935	28	55.28	326.83	9.79
Ionia	64,223	10,370	4	75	2	38.57	116.78	3.11
Jackson	159,494	24,512	41	585	1	167.27	366.78	0.63
Kalamazoo	260,263	59,224	57	629	5	96.24	241.68	1.92
Kent	636,369	112,959	54	818	36	47.80	128.54	5.66
Lapeer	88,373	11,878	13	134	2	109.45	151.63	2.26
Lenawee	98,573	14,785	16	196	7	108.22	198.84	7.10
Livingston	187,316	24,673	20	112	7	81.06	59.79	3.74
Luce-Mackinac-Alger-Schoolcraft	34,861	4,040	12	8	2	297.03	22.95	5.74
Macomb	864,840	129,505	184	3,502	109	142.08	404.93	12.60
Marquette	67,215	14,553	18	40	0	123.69	59.51	0.00
Midland	83,632	12,627	9	231	2	71.28	276.21	2.39
Mid-Michigan	181,875	27,459	16	222	8	58.27	122.06	4.40
Monroe	149,568	20,749	62	563	18	298.81	376.42	12.03
Muskegon	172,790	26,095	32	528	15	122.63	305.57	8.68
Northwest Michigan	106,806	13,166	35	130	3	265.84	121.72	2.81
Oakland	1,242,304	179,186	154	2,164	22	85.94	174.19	1.77
Ottawa	279,955	54,302	16	294	3	29.46	105.02	1.07
Saginaw	193,307	31,620	42	441	3	132.83	228.13	1.55
Sanilac	41,475	5,139	4	56	0	77.84	135.02	0.00
Shiawassee	68,619	9,762	4	128	3	40.98	186.54	4.37
St Clair	159,875	21,755	50	673	10	229.83	420.95	6.25
Tuscola	53,777	7,215	5	51	2	69.30	94.84	3.72
Van Buren-Cass	126,734	16,506	12	177	3	72.70	139.66	2.37
Washtenaw	358,880	92,722	29	661	26	31.28	184.18	7.24
Wayne	1,082,215	170,201	264	4,035	147	155.11	372.85	13.58
Western Upper Peninsula	68,561	13,721	21	41	2	153.05	59.80	2.92
MDOC	43,359	8,299	236	-	-	2,843.72	-	-
Statewide†	9,922,572	1,618,597	2,060	25,910	644	127.27	261.12	6.49

*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	2016 Chronic HCV Cases	2016 Acute HCV Cases	2016 Chronic HBV Cases	2016 Acute HBV Cases	2016 Chronic HCV Rate*	2016 Acute HCV Rate*	2016 Chronic HBV Rate*	2015 Acute HBV Rate*
1	1,073,759	796	11	96	2	74.13	1.02	8.94	0.19
3	1,114,262	1,242	21	106	3	111.46	1.88	9.51	0.27
5	954,568	757	20	54	1	79.30	2.10	5.66	0.10
6	1,497,918	918	11	139	3	61.29	0.73	9.28	0.20
7	441,536	354	11	18	3	80.17	2.49	4.08	0.68
8	305,731	365	13	19	4	119.39	4.25	6.21	1.31
2N	2,267,019	2,185	52	307	12	96.38	2.29	13.54	0.53
2S	2,267,779	4,557	13	515	18	200.95	0.57	22.71	0.79
MDOC	43,359	704	2	29	0	1,623.65	4.61	66.88	0.00
Statewide†	9,922,572	11,883	154	1,284	46	119.76	1.55	12.94	0.46

*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	2016 Young Adult (18-29) HCV Cases	2016 Heroin Treatment Admissions	2015 Heroin Overdose Deaths	2016 Young Adult (18-29) HCV Rate*	2016 Heroin Treatment Admission Rate*	2015 Heroin Overdose Death Rate*
1	1,073,759	193,687	172	2,355	58	88.80	219.32	5.40
3	1,114,262	160,095	261	3,085	43	163.03	276.86	3.86
5	954,568	155,990	149	2,174	39	95.52	227.75	4.09
6	1,497,918	270,404	140	2,084	68	51.77	139.13	4.54
7	441,536	54,128	102	441	10	188.44	99.88	2.26
8	305,731	50,580	116	145	4	229.34	47.43	1.31
2N	2,267,019	330,446	388	6,339	141	117.42	279.62	6.22
2S	2,267,779	403,267	495	9,277	278	122.75	409.08	12.26
MDOC	43,359	8,299	236	-	-	2,843.72	-	-
Statewide†	9,922,572	1,618,597	2,060	25,910	644	127.27	261.12	6.49

*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