

IMPACT OF RECREATIONAL CANNABIS LEGALIZATION IN MICHIGAN: A BASELINE REPORT

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**INJURY PREVENTION
CENTER**
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LIST OF ABBREVIATIONS

- CUD** – Cannabis Use Disorder
- DCE/SP** – Domestic Cannabis Eradication and Suppression Program
- DEA** – Drug Enforcement Administration
- DTOs** – Drug Trafficking Organizations
- ED** – Emergency Department
- FARS** – Fatality Analysis Reporting System
- FY** – Fiscal Year
- HIDTA** – High Intensity Drug Trafficking Area
- JDW** – Judicial Data Warehouse
- LARA** – Licensing and Regulatory Affairs
- MAPS** – Michigan Automated Prescription System
- MAT** – Medication Assisted Therapies
- MDHHS** – Michigan Department of Health and Human Services
- METRC** – Marijuana Enforcement Tracking Reporting & Compliance
- MHA** – Michigan Health and Hospital Association
- MIDB** – Michigan Inpatient Database
- MI PRAMS** – Michigan Pregnancy Risk Assessment Monitoring System
- MiVDRS** – Michigan Violent Death Reporting System
- MLOs** – Money Laundering Organizations
- MMFLA** – Medical Marihuana Facilities Licensing Act
- MMMA** – Michigan Medical Marihuana Act
- MODB** – Michigan Outpatient Database
- MRTMA** – Michigan Regulation and Taxation of Marihuana Act
- MTCF** – Michigan Traffic Crash Facts
- MVC** – Motor Vehicle Crash
- NVDRS** – National Violent Death Reporting System
- NSDUH** – National Survey on Drug Use and Health
- RSE** – Relative Standard Error
- TEDS** – Treatment Episode Data Set
- THC** – Tetrahydrocannabinol
- UPS** – United Parcel Service
- US** – United States
- USPIS** – United States Postal Inspection Services
- USPS** – United States Postal Service
- VMT** – Vehicle Miles Traveled

BACKGROUND AND PURPOSE OF THIS REPORT

On November 6, 2018, Michigan voters approved Proposal 1, which created the Michigan Regulation and Taxation of Marihuana Act (MRTMA), effective December 6, 2018. The law effectively allows for:

- Personal possession and use of cannabis by adults ages 21 and older
- Lawful cultivation and sale of cannabis and industrial hemp by adults age 21 and older
- Taxation of revenue from commercial cannabis facilities.

Michigan was the 10th state (including the District of Columbia) in the country, and the first state in the Midwest to pass a recreational cannabis law (10 years after the approval of the use and distribution of medical cannabis in 2008). Although cannabis remains a Schedule I *federally* prohibited substance, the 2018 Michigan recreational cannabis law and the 2008 Michigan medical cannabis law allows for increased access and exposure to cannabis throughout the State of Michigan. In light of this policy change, this report was planned to compile existing baseline data regarding what is known about the use of cannabis and its impact on the health and well-being of Michigan citizens and communities. This initial baseline report provides insights into cannabis-related injury, social, and health indicators prior to 2018, before the recreational cannabis law was enacted. This report sets the stage for future reports to examine whether changes in these indicators occur in the years following the passage of the 2018 MRTMA law. Examining these indicators over time will allow stakeholders and public health officials to best understand the health, social and economic impacts associated with the legalization of recreational cannabis.

EXECUTIVE SUMMARY

On November 6, 2018, Michigan voters approved Proposal 1, which created the Michigan Regulation and Taxation of Marihuana Act (MRTMA), effective December 6, 2018. The law allows for personal possession and use of cannabis by adults ages 21 and older, lawful cultivation and sale of cannabis and industrial hemp by adults age 21 and older, and taxation of revenue from commercial cannabis facilities. In light of this policy change, the University of Michigan Injury Prevention Center (IPC) compiled existing data regarding what is known about cannabis use in the State of Michigan across several domains that potentially affect the health and well-being of Michigan citizens and communities. This report is a baseline for any future evaluations of changes following recreational cannabis legalization. Examining these indicators over time will allow stakeholders and public health officials to best understand the potential impacts of recreational cannabis on the health and well-being of Michigan citizens. Key findings from the report are noted below; however, readers are encouraged to view the full report in order to understand the full breadth and depth of these findings.

KEY FINDINGS

Long-Term Trends in Cannabis Use

The prevalence of cannabis use, especially among young adults (ages 18–25), is increasing and remains higher in Michigan than the Midwest region and the U.S. as a whole.

- Around one in nine Michigan residents (11.6%) report past-month cannabis use. This percentage has increased over the last 14 years (for which data are available) by over 60% (with a percentage of 7.2% in 2002–2003 and 11.6% in 2016–2017) and is greater than the prevalence estimates in the Midwest and nationally. Almost all recent increases in the prevalence of cannabis use in Michigan occurred following legalization of medical cannabis use in 2008.
- Young adults (ages 18–25 years) are the age group with the highest percentage of reported cannabis use.
- A greater percentage of men use cannabis than women (12.9% of men and 8.3% of women report past-month cannabis use). The prevalence of use is also higher among non-Hispanic Black populations, those who are unemployed, and those with lower levels of educational attainment.
- Currently, Michigan residents most often obtain cannabis by getting it for free, sharing it with someone else, or buying it, as compared to growing it on their own or trading for it.

Long Term Trends in Cannabis Use Disorder

The percent of Michigan residents reporting symptoms that could be classified as a cannabis use disorder (CUD) (e.g., abuse or dependence) has remained stable since 2002, with a slight decline between 2013–2014. Among select subpopulations (ages 12–17; 18–25), the decline in symptoms suggestive of a CUD has been more consistent since 2008. Currently, there are no conclusive explanations for why this prevalence may have decreased, especially given that cannabis use has increased within some of these populations during the same time period. Additional data from later years are needed to understand these potential trends.

- The percentage of residents reporting symptoms that could be classified as a CUD was relatively stable between 2002 and 2015, between 1.5–2.0% of the population, with a slight decline in the past year of available data. The most recent data available indicate that approximately 1.5% of residents experience symptoms consistent with a possible cannabis use disorder.
- Subpopulations with the highest percentage of symptoms suggestive of a CUD are young adults (ages 18–25) and adolescents (ages 12–17). Percentages appear to be decreasing among both these subpopulations since 2002–2003.

Beliefs About Cannabis Use

Perceptions of the risks associated with cannabis use have decreased during the past 15 years (that data are available), with the perceived risks of harm lowest among young adult (ages 18–25) populations that report the highest percentage of use. Further, perceptions regarding the potential legal ramifications of cannabis possession have shifted towards an expectation of more lenient penalties. Despite this, the majority of adolescents report that they and their parents disapprove of cannabis use. Greater public health messaging that accurately conveys appropriate risks, harms, and potential benefits of cannabis use may be warranted.

- Overall, 21.8% of the Michigan population perceives that smoking cannabis once a month will result in a “great risk” of personal harm. This is a 34.2% decline in the percentage of residents perceiving a high level of harm since 2002–2003. Young adult populations (ages 18–25) have the lowest levels of risk perception.
- Perceptions that the legal penalties have shifted to be more lenient (e.g., move towards fines or no penalty rather than possible prison sentence) have grown in recent years among the Michigan population.
- Perceived ease of accessing cannabis remains high, with 65.3% of the Michigan population reporting that it would be fairly/very easy to obtain cannabis.
- Over nine in ten (95%) adolescents (ages 12–17) in Michigan believe that their parents disapprove of trying cannabis. This percentage remained stable from 2002–2003 to 2013–2014.
- Over 75% of adolescents (in 2013–2014) disapprove of their peers using cannabis. Among only those youth who have used cannabis in the past month, approximately 30% disapprove of their peers trying cannabis.

Cannabis Use and Pregnancy

Most expectant mothers do not use cannabis in the months before, during, or after pregnancy, and those that do use any cannabis are most likely to use before, but not during, or after pregnancy. Findings may reflect sociodemographic risk factors for cannabis use in general and/or disparities in access to healthcare or prevention services.

- The vast majority (86.7%) of Michigan expectant mothers did not use cannabis before, during, or after pregnancy.
- Approximately one in thirty mothers (~3%) reported using cannabis while pregnant.
- Use during pregnancy was most common for women who were under 30 years of age (4.2%), did not complete high school (6.4%), and had an annual income of less than \$16,000 (8.8%).
- Women who were not married were four times more likely to use during pregnancy compared to married women (5.6% vs. 1.4%), and non-Hispanic Black mothers were twice as likely to use cannabis while pregnant compared to mothers from all other race/ethnicity categories (5.3% vs. 2.6%).
- Among mothers who quit using cannabis during pregnancy, the majority (79.5%) did not return to cannabis use in the months following birth.

Cannabis Use in the Michigan Workforce

In comparing the Michigan workforce to the national workforce, Michigan employees have a higher prevalence of positive urine drug tests for cannabis than the national average, and the percentage of positive urine drug tests is increasing. Additional data are needed on workplace policies for hiring and employee assistance programs for employees who test positive and may have a cannabis use disorder.

- Among potential new employees who are drug tested, 3.3% screen positive for cannabis, which is an increase of 50% from 2007 through 2018. Increases appear to have started in 2009 following legalization of medical cannabis use, although pre-legalization data is only available since 2007.
- The percentage of Michigan employees testing positive, and the rate of increase over these 11 years (2007–2018) is greater in Michigan than nationally.

Medical Cannabis

Many Michigan residents are using cannabis for medical purposes, and the number of people reporting cannabis use for medical purposes has increased over the past 7 years (from 2011 to 2018).

- In 2018, 297,515 patients (3% of the state population) held a medical cannabis certification.
- Over the past 7 years (from 2011 to 2018), the total number of patients with a medical cannabis certification has increased about 2.5 times.
- The number of registered caregivers (individuals who cultivate cannabis for specified patients) has fluctuated over the years, with the most recent data indicating that there were 43,056 caregivers in 2018.
- In 2018, 91.1% of patients reported severe and chronic pain as a reason for medical cannabis certification, which is the most frequently listed reason since the program began.

- The net revenue associated with the state administering and operating the medical cannabis program (i.e., processing applications and renewal applications for the medical cannabis programs and issuing of registry ID cards, excluding sales at dispensaries) typically ranged from \$5 to \$7 million per year (2011–2018).
- Recent passage of the Medical Marijuana Facilities Licensing Act (MMFLA) has created a regulatory structure for producing and selling medical cannabis in Michigan, with applications for licensing beginning in December 2017. A survey in Spring 2018 found that 75% of state jurisdictions chose to prohibit medical cannabis facilities under the MMFLA.
- In fiscal year (FY) 2018, \$4.6 million was collected from MMFLA facility license application fees (i.e., to operate dispensaries, etc.) and \$1.2 million was collected for regulatory assessments, while the cost of administering the program was \$8.2 million. Revenue collected during the first quarter alone of fiscal year 2019 was almost \$9.7 million.
- Data from October 2018 through March 2019 showed that total medical cannabis sales at licensed facilities was \$56.4 million.

Cannabis and the Opioid Epidemic

Opioid overdose deaths have increased in Michigan over the same time period as cannabis use has increased and legalization of medical cannabis has occurred. The potential impact of legal recreational cannabis remains to be seen, and data do not tell us about individuals who were at risk for overdose who may have switched from opioids to cannabis or other options for pain management. Further data are needed.

- According to the Michigan Automated Prescription System (MAPS), the number of opioid prescriptions dispensed increased from 9.7 million in 2013 to more than 10 million per year from 2014–2016. In 2017, the number of opioid prescriptions dispensed returned to below the 2013 level (9.4 million).
- Despite decreasing prescriptions, according to data from Michigan Death Certificates, opioid overdose deaths have been rising in recent years, in part due to increases in heroin and fentanyl use. Opioid overdose deaths across all ages in Michigan increased 836% from 2002 to 2017.
- During the same years (2002–2017), the percentage of Michigan citizens ages 12 and older who used cannabis increased by 32.5%.

Motor Vehicle Crashes and Impaired Driving

Although the annual rate of fatal motor vehicle crashes (MVC) per 100 million vehicle miles traveled in Michigan has decreased, the percentage of cannabis-involved fatal crashes is increasing, underscoring the need for public health approaches to prevent drivers operating vehicles under the influence of cannabis. Increased and more consistent testing in fatal and non-fatal motor vehicle crashes and other traffic incidents is needed to better characterize the involvement of cannabis in driving-related outcomes.

- Overall, the rate of fatal MVCs (per 100 million vehicle miles traveled) in Michigan has declined 11.4% over the last 13 years from 1.14 in 2004 to 1.01 in 2017.
- The percentage of toxicology testing has nearly doubled since 2004, with 40.6% of drivers involved in fatal crashes in 2017 tested for drugs.
- Cannabis is not always tested for and/or reported in MVC drug test results in Michigan. Among those fatal crashes where cannabis was tested, the proportion of tests that were positive for cannabinoids more than tripled over 13 years (6.7% in 2004 to 23.4% in 2017).
- Among Michigan medical cannabis patients, the prevalence of driving after recent cannabis use is 56.4%, while a "little high" is 50.5%, and while "very high" is 21.1%, with these patients also reporting that they frequently drive under the influence of cannabis.

Cannabis-Related Mortality

Cannabis poisoning as a primary cause of death is extremely rare, but may be a contributing factor to mortality in patients with underlying cardiovascular disease or other severe medical problems. Improved efforts are needed for tracking cannabis involvement in deaths via more uniform toxicology testing.

- Cannabis poisoning was recorded as the primary cause of death for fewer than 6 deaths for the total time period combined (i.e. from 2004–2017, there were fewer than 6 deaths with cannabis poisoning as the primary cause of death).
- Cannabis poisoning was recorded as related to the cause of death for a total of 45 deaths during the same time period.

Suicides and Homicides

Suicide and homicide victims often test positive for cannabis. Prevention programs could potentially benefit from addressing cannabis use to help mitigate risk of these types of death.

- Among individuals in Michigan who died by suicide in 2016 and who were also tested for cannabis, 1 in 5 were positive for cannabis. Men and young adult suicide victims were the groups with the highest percentage of positive cannabis tests.
- About half of Michigan homicide victims tested in 2016 were positive for cannabis. Men and young adult homicide victims were the groups with the highest percentage of positive tests.

Healthcare Utilization

Emergency Department (ED) visits for cannabis-related conditions are increasing. These types of ED visits will be important to monitor over time, especially given recent state-level recreational legalization that could increase access to more high potency products.

- In 2017, ED utilization related to cannabis use included visits with a diagnosis of adverse effects of cannabis use (2.9 per 100,000), cannabis poisoning (4.8 per 100,000), and cannabis-related disorders (324.8 per 100,000). Rates of these diagnoses have increased since 2016.
- Among visits with a diagnosis of cannabis poisoning, 15–24 year-olds account for the largest proportion of visits (2016: 34.9%; 2017: 33.3%), while 25–34 year-olds account for the largest proportion of visits with a medical illness associated with a cannabis-related disorder (as any listed diagnosis; 2016: 27.7%, 2017: 28.5%).
- The gender breakdown for ED visits shows that, in most cases, males were slightly more likely to have any of these diagnoses than females.

Although small in number, inpatient hospitalizations due to cannabis poisonings have increased since 2010. This highlights the need for prevention programs aimed at adolescents and young adults to reduce risky cannabis use, especially as higher potency cannabis-containing products (e.g., edibles) become available for recreational purchase at dispensaries.

- The rate of hospitalization for cannabis poisoning varied over the years; it increased from 2010 (2.5 per 100,000) to 2012 (3.1 per 100,000), decreased over the next few years to 2.5 per 100,000 in 2015, and increased nearly 1.5 times by 2017 (3.7 per 100,000). Youth aged 15–24 years (29.6%) and males (59.7%) made up the largest proportion of these hospitalizations.
- The rate of inpatient hospitalizations for medical illness associated with a cannabis-related disorder (i.e., as any listed diagnosis) nearly doubled from 2010 (206.4 per 100,000 persons) to 2017 (407.0 per 100,000 persons). Adults aged 25–34 years and males made up the largest proportions of these hospitalizations.

Substance use disorder treatment admissions for cannabis as the primary drug associated with admission have decreased in state programs. This may reflect reductions in treatment availability during the rise of the opioid epidemic.

- Cannabis-related treatment admissions were highest in Michigan in 2010 (18.8% of treatment admissions), but decreased overall by half from 16.9% in 2005 to 8.4% in 2018.
- In 2018, men accounted for 64% of treatment admissions related to cannabis.
- From 2014–2018, cannabis-related treatment admissions as a proportion of all treatment admissions declined in all age groups: adolescents 12–17 years declined 55.6%, young adults 18–25 years by 46.9%, adults 26 and older by 33.3%.
- Counties that demonstrated the largest increases in treatment admissions from 2005 to 2018 were: Branch, Benzie, Charlevoix, Iosco, and Ontonagon.

Criminal Justice and Legal System Data

Cannabis-related criminal justice data show a slight decline since 2014 in the percentage of cannabis-related convictions among all felony and misdemeanor convictions, which require future monitoring given changes in the legal status of cannabis.

- Of nearly 2.5 million misdemeanor and felony convictions in Michigan from 2012 to 2018, there were nearly 95,838 (3.8%) cannabis-related convictions, with about 50,772 (2.0%) cannabis-related convictions occurring concurrent with other felony convictions.
- The percentage of cannabis-related convictions among all convictions was highest in 2014 (4.2%) and lowest in 2018 (3.2%).
- From 2012–2018, 53% of cannabis-related convictions involved a concurrent felony conviction.
- The number of cannabis-related charges increased overall by about 2.4% from 2012 (18,956) to 2018 (19,406), with the number of charges peaking in 2016 (22,992).

Trends in cannabis seizures by law enforcement vary based on the type of cannabis, with outdoor seizures decreasing the most and edible cannabis product seizures increasing the most. These changes may reflect trends in cannabis production and/or law enforcement priorities.

- Michigan HIDTA teams seized 4,886 kilograms of indoor grown cannabis plants in 2010. This dropped in 2014 (3,398 kilograms), but increased again in 2015 (7,226 kilograms), and then declined steadily to 4,173 kilograms in 2018. Overall, this was a 14.6% decrease from 2010 to 2018.
- Outdoor grown cannabis plant seizures decreased by 96.8% from 21,418 kilograms in 2010 to 686 kilograms in 2018.
- The total weight of edible cannabis product seizures increased by a factor of over 400 times, from 2.48 kilograms in 2013 to 1,082 kilograms in 2018.
- From 2010–2018, the seizure of bulk processed cannabis was highest in 2010 (10,772 kilograms), declined steadily through 2013 (3,086 kilograms), but gradually began to rise again in 2016.
- The total wholesale value of bulk processed cannabis seized increased from \$23.6 million in 2010 to \$32.1 million in 2018.
- Based on threat assessments produced annually, Michigan HIDTA enforcement teams have focused their investigative efforts and resources on prescription drug diversion, heroin and opioid trafficking for the past several years due to the seriousness of the threat posed by these drugs.

The number of drug trafficking organizations investigated by Michigan HIDTA enforcement teams that are trafficking cannabis has decreased somewhat.

- Cannabis is trafficked into Michigan from other states through the U.S. mail, express consignment, as well as via plane, truck, and motor vehicle.
- For fiscal year (FY) 2018, the top three destinations for shipped packages containing cannabis were: Detroit, Grand Rapids, and Kalamazoo.
- Drug trafficking organizations (DTOs) use major interstate highways in Michigan, especially I-75 and I-94, to transport cannabis.
- The number (and percentage) of DTOs under investigation that were trafficking cannabis fell from 151 DTOs (or 52% of all DTOs under investigation) in 2013 to 88 DTOs (or 39% of all DTOs under investigation) in 2018.
- Based on threat assessments produced annually, Michigan HIDTA enforcement teams have focused their investigative efforts and resources on prescription drug diversion, heroin and opioid drug trafficking organizations for the past several years due to the seriousness of the threat posed by these organizations.

Economic Indicators

Locally grown cannabis is more highly valued than imported cannabis from Mexico, indicative of higher quality cannabis grown locally. Economic indicators will need to be tracked to examine how the price of cannabis changes as a result of legalization for recreational use.

- Law enforcement data indicate that cannabis is generally acquired in Michigan from private residences, street sales, or from medical dispensaries. The street value of locally grown cannabis (ranging from \$1,800-\$4,000 per pound) is higher than imported cannabis (\$450-\$1,200 per pound).

Although the data summarized in this report reflect a variety of areas potentially impacted by cannabis use, there are a number of other areas where data sources were unavailable or were outside the scope of the current report. In addition to addressing these limitations, to the extent data becomes available in the future, several additional areas for tracking cannabis-related trends over time are suggested. Key suggestions include cannabis-related data for: non-fatal motor vehicle crashes, vaping cannabis-related illnesses, workplace injuries, residential and industrial fires due to cannabis use and production, and poison control center calls. Additionally, it is recommended that data be identified on cannabis-related indicators affecting Michigan youth such as Child Protective Services reports, school suspensions, and school expulsions. Regarding cannabis production in the state, there is a potential environmental impact through energy and water consumption. Additional information about these and other areas may provide a more comprehensive view of the impact of cannabis legalization in Michigan.

LONG-TERM TRENDS IN CANNABIS USE

INTRODUCTION

Although medical and recreational cannabis use is legal at the state level in Michigan and many other states, cannabis remains an illegal substance at the federal level with no exemptions for medical use. Despite this, cannabis is the most common illicit drug used in Michigan, as well as throughout the United States (U.S.). Further, it is the third most commonly used substance with addictive properties, behind alcohol and tobacco.¹

This section of the report compiles data on long-term trends in cannabis use and will address how cannabis use has changed over time in Michigan, providing comparisons to both the Midwest and the U.S. in general. These trends reflect the time periods before and after the passage of the Michigan medical cannabis law (2008) and will be able to be used in future iterations of this report to determine how the use of cannabis may change following the passage of the recreational cannabis law.

Although not reported here, when evaluating cannabis use over time, it is important to note that there are documented increases in the average amount of Delta-9-tetrahydrocannabinol (THC – the psychoactive component of cannabis that results in a “high”) found in cannabis nationally,² and that this increase in potency increases the risk for the onset of symptoms of cannabis use disorder (CUD).³

FINDINGS

The National Survey on Drug Use and Health (NSDUH)– which began in 1971 –is a nationwide study that provides current data on alcohol, drug, and tobacco use, mental health, and other related health issues in the U.S. It is one of the most comprehensive population-based surveys of drug use and health in the U.S. and is conducted in all 50 states and the District of Columbia.⁴ Each year, the NSDUH team interviews U.S. residents aged 12 years or older. All interviews are conducted in private. State-level estimates for Michigan are from the Interactive NSDUH State Estimates website (available at: <https://pdas.samhsa.gov/saes/state>), where data is provided in combined two-year intervals.

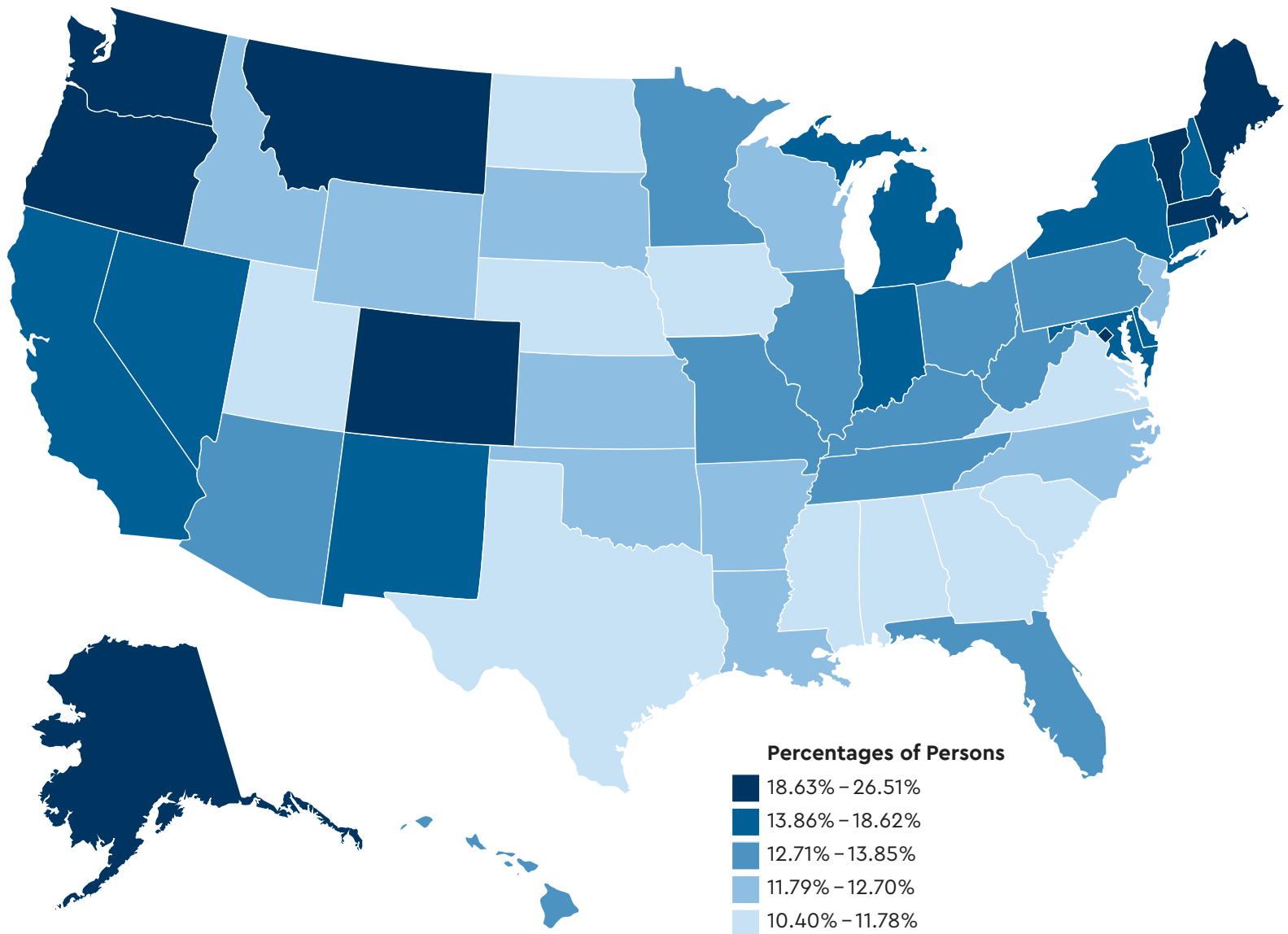
Trends in the Percentage of People Reporting Past-Year Cannabis Use

In the following section, data from the NSDUH is used to describe the percentage (prevalence) of people using cannabis in Michigan, how these estimates have changed over time, and how these percentages compare with the rest of the U.S. Understanding the percentage of people in Michigan using cannabis, and the trends in this use over time, will allow public health practitioners to monitor any changes in prevalence of use as the recreational cannabis law is enacted and will allow for comparisons with other states that have similar laws. Note that data on both past-year and past-month cannabis use is reported in this document for the sake of completeness and future comparisons. Further, it is important to note that NSDUH measures “cannabis use” by asking about use of marijuana or hashish that is usually smoked, cooked in food, or used as hash oil.

Past-Year Cannabis Use in Michigan

- In 2016–2017, 16.7% of Michigan residents reported past-year cannabis use.
- This ranks 15th out of the 50 states and the District of Columbia in terms of the percentage of residents that reported past-year cannabis use in 2016–2017.
- Of note, Oregon had the highest percentage of residents reporting cannabis (26.5% of state population) and Utah had the lowest percentage of residents reporting cannabis use (10.4% of state population)⁵ (See figure 1). [Note: During 2016–2017, Oregon had recreational and medical cannabis laws, while Utah did not.]

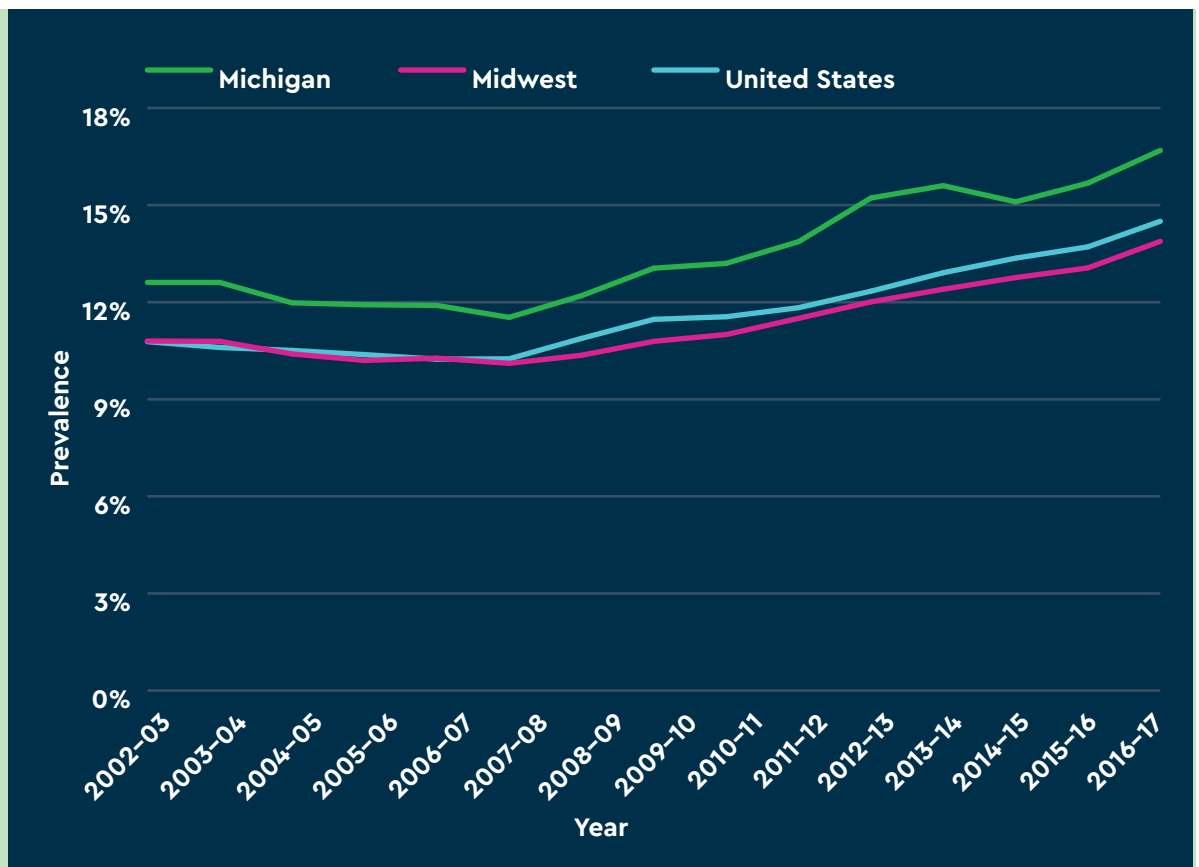
FIGURE 1: Cannabis Use in the Past Year among Individuals Aged 12 or Older, by State 2016–2017



Comparing Trends in Michigan to the Midwest and other U.S. States

- Between 2002–2003 and 2016–2017, there was a 32.5% increase in reported past-year cannabis use among Michigan residents (i.e., 12.6% in 2002–2003 to 16.7% in 2016–2017)⁵ (See figure 2).
- In 2016–2017, the percentage of Michigan residents reporting past-year cannabis use in 2016–2017 (16.7%) is higher than residents in the Midwest region (13.9%), as a whole, as well as the U.S. overall (14.5%).
- Examination of these trends since 2002–2003 suggests that Michigan's rate of increase for past-year cannabis use (i.e., 32.5% increase in prevalence of use since 2002–2003) is increasing slightly faster than the Midwest region as a whole (i.e., the prevalence of past year use has increased by 28.5% since 2002–2003), but is parallel to the overall U.S. prevalence, which has increased 34.5% since 2002–2003.
- The increases in prevalence of past-year cannabis use have almost exclusively occurred since 2008, which coincides with the legalization of medical cannabis use in Michigan in the same year, with the prevalence of past-year use relatively flat between 2002–2003 and 2007–2008, followed by a 36.8% increase in prevalence between 2008–2009 and 2016–2017.

FIGURE 2:
Cannabis Use
in the Past
Year among
Individuals
Aged 12 or
Older, by
Geographic
Area



Past-Year Cannabis Use in Michigan by Age Group

- In Michigan, the young adult age group (ages 18–25) has the highest percentage of cannabis use, as compared with other age groups, with 38.0% reporting past-year use in 2016–2017 (See figure 3).

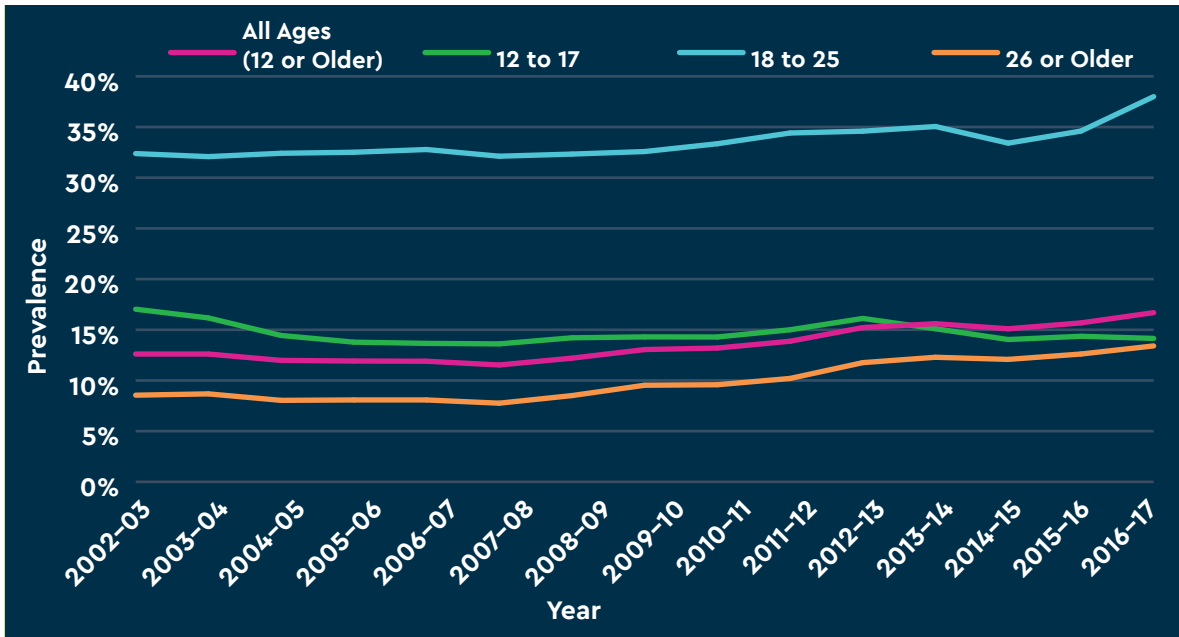


FIGURE 3:
Cannabis Use
in the Past
Year among
Individuals
Aged 12 or
Older in
Michigan, by
Age Group

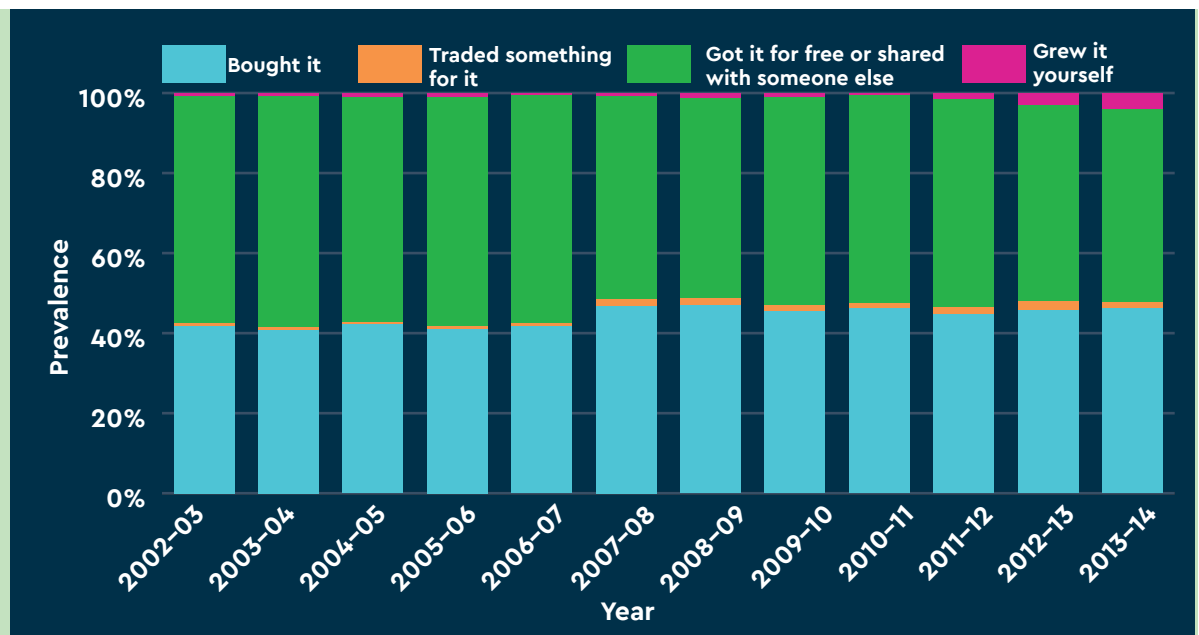
Trends in How Individuals Obtain Cannabis in Michigan

The following section details the trends in how individuals obtain cannabis. To the extent data become available, it is important to understand how these trends change over time, especially given that medical and recreational legalization allows for growing cannabis and purchasing from both medical and recreational dispensaries.

Mode of Obtaining Cannabis

- In 2013–2014, among Michigan residents reporting cannabis use in the past year, the primary mode of obtaining cannabis⁶ was either getting it for free (does not include growing it oneself) or sharing it with someone else (48.0%). This has remained the most common method for obtaining cannabis every year of the survey since 2002–2003.
- Other modes of obtaining cannabis have increased from 2002–2003 to 2013–2014. These include purchasing cannabis (increased 10.3% from 41.8% to 46.1%), trading something for it (increased nearly 2.5 times from 0.7% to 1.7%), and growing it oneself (increased over 5 times from 0.8% to 4.2% in 2013–2014). Of note, the increase in “growing cannabis oneself” as a mechanism for obtaining cannabis has primarily occurred since the 2008 passage of medical legalization (from 1.1% in 2008–2009 to 4.2% in 2013–2014) (See figure 4).

FIGURE 4:
Percentage of Mode of Obtaining Cannabis among Individuals aged ≥ 12 in Michigan who report Cannabis Use in the Past Year



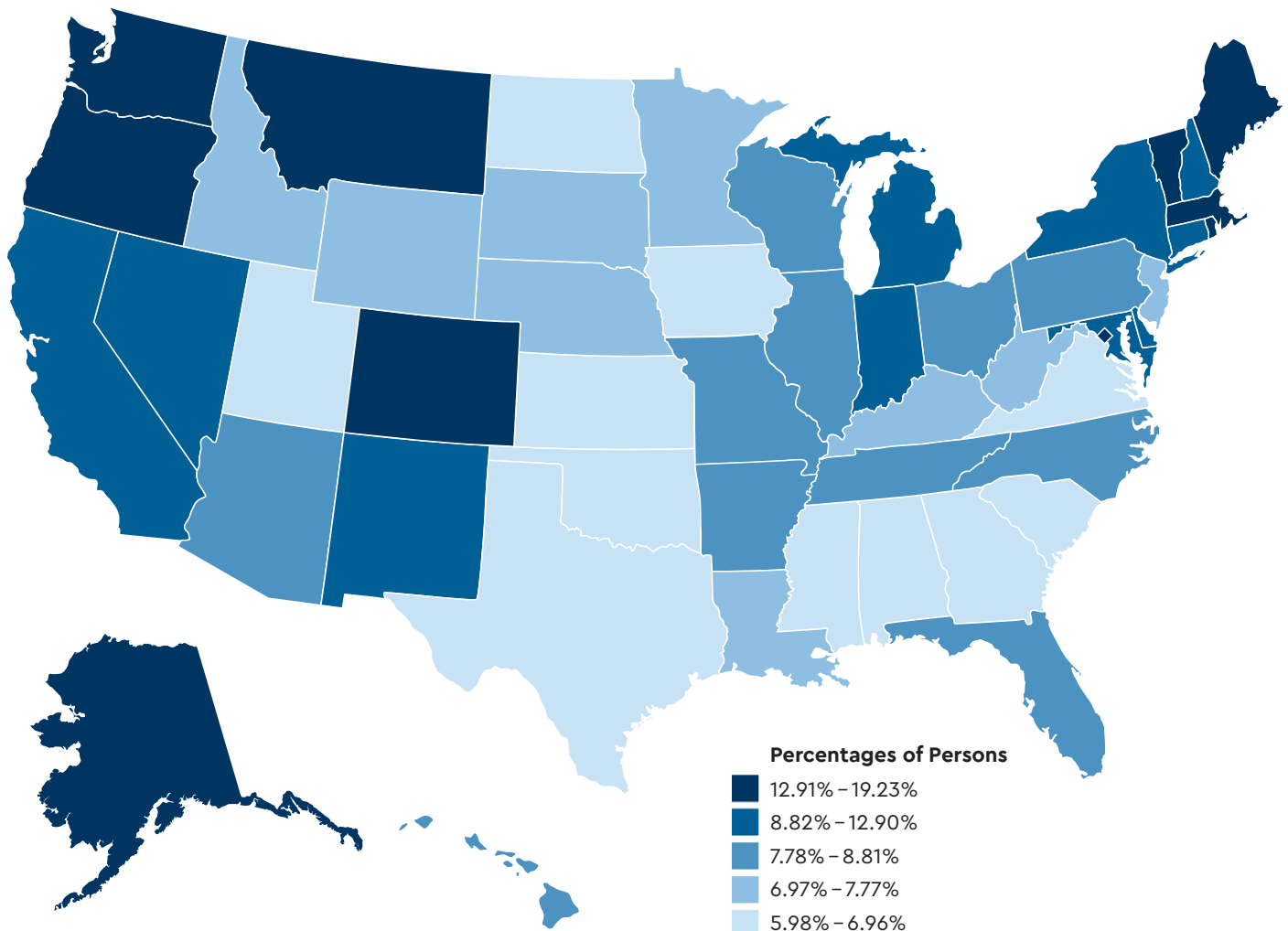
Trends in the Percentage of People in Michigan Reporting Past-Month Cannabis Use

In the following section, data from the NSDUH is used to describe the percentage of people reporting cannabis use in the past month in Michigan, how this use has changed over time, and how these trends compare to other U.S. states.

Past-Month Cannabis Use in Michigan

- Between 2016–2017, 11.6% of Michigan residents reported past-month cannabis use.
- This ranks 14th out of the 50 states and the District of Columbia with respect to the percentage of residents reporting past-month cannabis use.
- For comparison, Oregon had the highest percentage of residents reporting past-month cannabis use (19.2% of population), and Texas had the lowest (6.0% of population)⁵ (See figure 5). [Note: During 2016–2017 Oregon had recreational and medical cannabis laws, while Texas did not.]

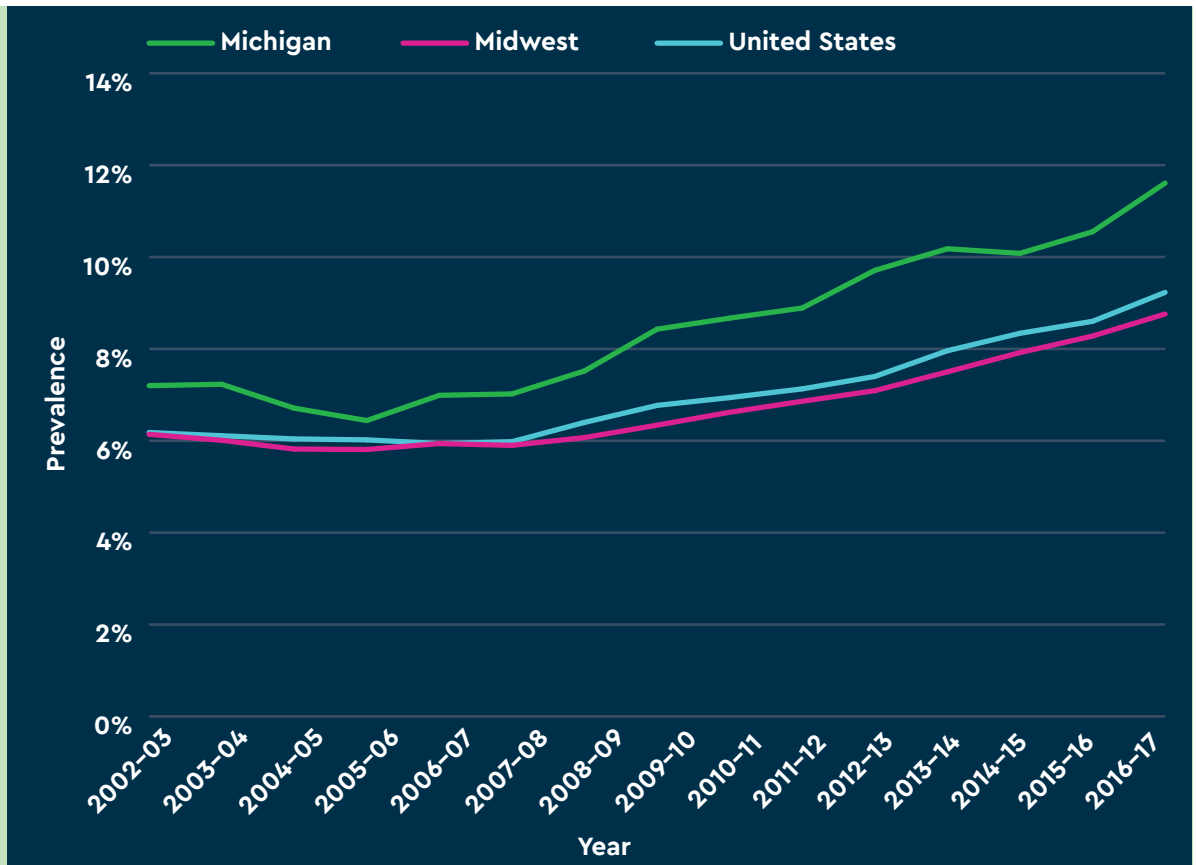
FIGURE 5:
Cannabis Use in the Past Month among Individuals Aged 12 or Older, by State: 2016–2017.



Comparing Trends in Michigan to the Midwest and other U.S. States

- The prevalence of past-month cannabis use in Michigan has increased 61.1% since 2002–2003, rising from a prevalence of 7.2% in 2002–2003 to 11.6% in 2016–2017 among individuals aged 12 years or older⁵ (See figure 6).
- The percentage of people reporting past-month cannabis use has been consistently higher in Michigan than in the Midwest region, as a whole, or the United States, overall since 2002–2003.
- Examination of these trends shows that rates of increase among Michigan residents (61.1% increase in prevalence since 2002–2003) have been faster than those among other residents within the Midwest region as a whole (increased 45.8% between 2002–2003 and 2016–2017), as well as general U.S., which increased 49.3% between 2002–2003 and 2016–2017.
- Of note, the increasing percentage or prevalence of past-month cannabis use across Michigan residents has almost exclusively occurred since the legalization of medical cannabis in 2008, with a relatively stable prevalence between 2002–2003 and 2007–2008, and a 65.4% increase in the prevalence of past-month use between 2007–2008 and 2016–2017.

FIGURE 6:
Cannabis Use
in the Past
Month among
Individuals
Aged 12 or
Older, by
Geographic
Area



Past-Month Cannabis Use in Michigan by Age Group

- In Michigan, young adults (ages 18–25) have the highest proportions of past-month cannabis use when compared to other age groups, with 24.2% reporting past-month use in 2016–2017⁵ (See figure 7).

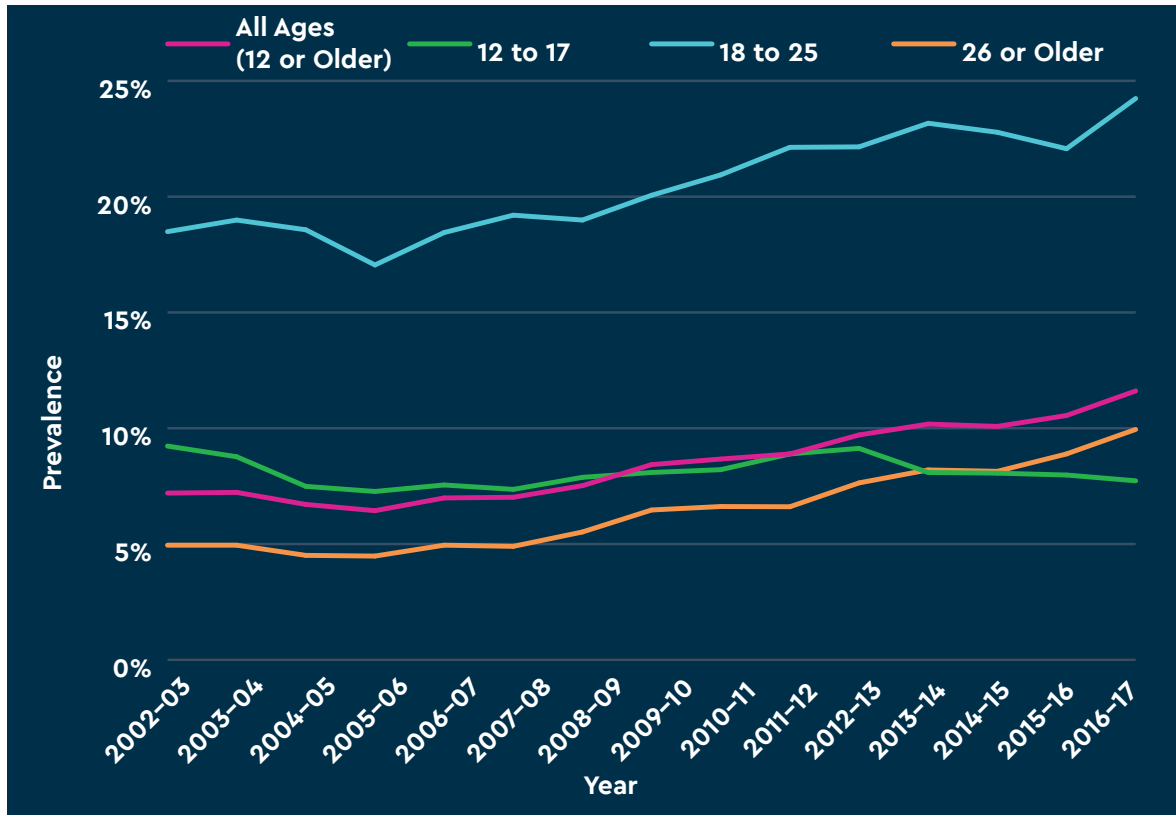


FIGURE 7:
Cannabis Use in the Past Month among Individuals Aged 12 or Older in Michigan, by Age Group

Cannabis Use among Sociodemographic Subgroups in Michigan

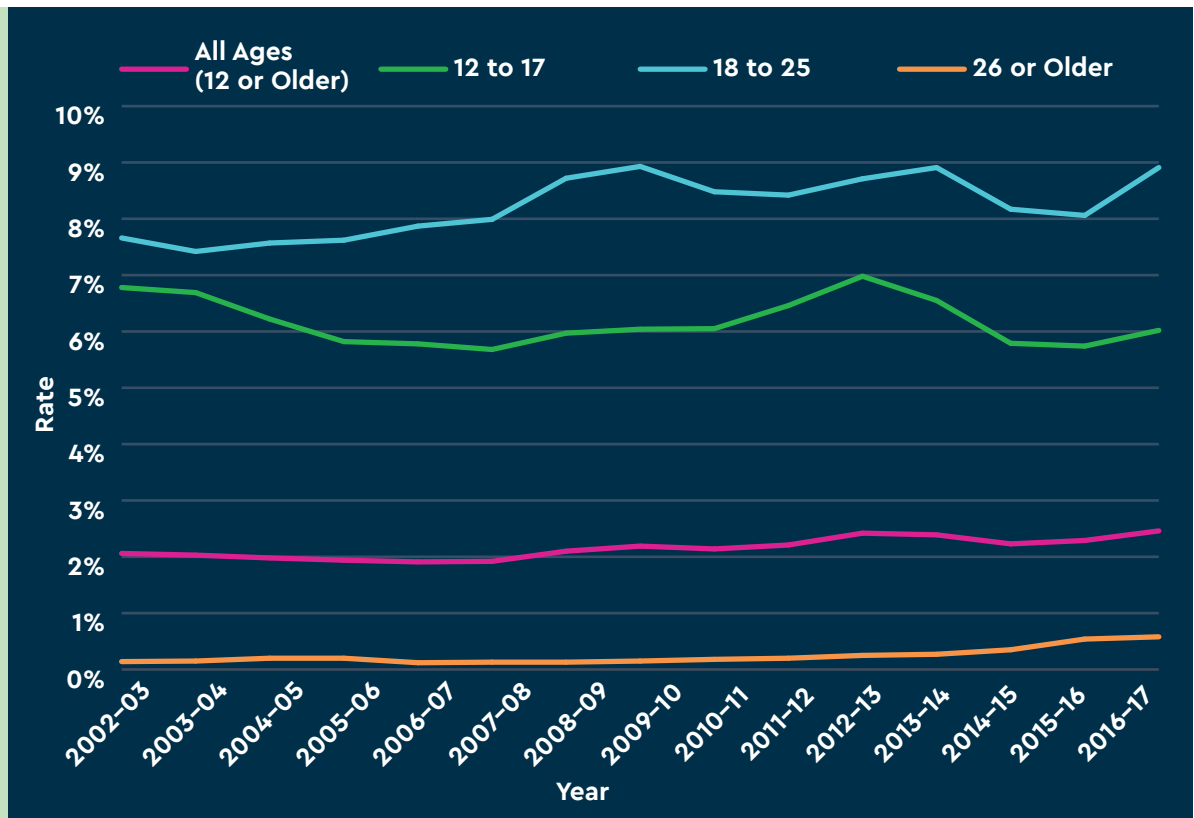
- Past-month cannabis use is consistently higher among males than females: 12.9% of males and 8.3% of females reported past-month cannabis use in 2013–2014 (the most recent year demographic characteristics are reported).
- Past-month cannabis use by race and ethnicity was highest among non-Hispanic Blacks with 16.8% reporting past-month use in 2013–2014.
- Past-month cannabis use was consistently highest among those who were unemployed (in 2013–2014, 22.6% of those unemployed) and those with less than a high school degree (in 2013–2014, 18.7% of those who did not complete a high school degree).
- Daily or almost daily past-month cannabis use increased by 6.3% from 2002–2003 to 2013–2014, with the highest percentage of daily or almost daily use occurring among those aged 18–25 years (2013–2014 prevalence=45.5%).

Initiation of Cannabis Use among Michigan Residents

The following section details the percentage of individuals who report that they used cannabis for the first time in the past year. Examining the trends regarding these estimates may give public health professionals an understanding of how legalization at both the medical and recreation level affects the initiation of cannabis use, and whether additional prevention programming needs to be implemented in the state in response to changes in policy regarding cannabis use.

- In 2016–2017, 2.5% of all Michigan residents (ages 12 or older) reported using cannabis for the first time (See figure 8).
- This is a 19.4% increase in first-time cannabis use when comparing rates in 2016–2017 (2.5%) to rates in 2002–2003 (2.1%).⁵
- In Michigan, the highest percentage of first-time use has consistently been among young adult populations (ages 18–25) since 2002–2003, with the lowest rate of first-time use occurring among those who are aged 26 and older.

FIGURE 8:
Average
Annual Rate
of First Use of
Cannabis in
Michigan, by
Age Group





CONCLUSIONS

- Prevalence estimates of cannabis use (past year and past month), or the percentage of residents using cannabis, in Michigan are higher than those observed in the entire Midwest region and across the United States, as a whole.
- Prevalence of use (past year and past month) has been increasing across Michigan since 2002–2003, and increasing faster in Michigan than across the Midwest. Almost all of the observed increases in prevalence for Michigan have occurred in the years following legalization of medical cannabis use.
- When examining population subgroups, groups with the highest percentage of use were observed among young adults (ages 18–25), males, non-Hispanic Blacks, unemployed residents, and those with lower educational attainment.
- Although primary modes of obtaining cannabis have remained consistent over time (i.e., getting it for free/sharing it), the percentage of those purchasing cannabis, trading something for it, and growing it oneself have increased since the passage of the Michigan Medical Legalization Law in 2008.
- If not initiating cannabis use during adolescence (ages 12–17) or young adulthood (ages 18–25), few Michigan residents over the age of 26 begin to use cannabis for the first time.

LONG TERM TRENDS IN CANNABIS USE DISORDER

INTRODUCTION

Cannabis use disorder (CUD; i.e., the presence of clinical diagnostic criteria for abuse or dependence) is a serious medical condition requiring specialized medical treatment. Typical manifestations of cannabis use disorder include, but are not limited to, using larger amounts of the drug or using for longer periods than intended, hazardous use (e.g., using in situations that increase risk for danger, such as driving), school or work problems related to use, tolerance to cannabis's effects, repeated attempts to quit or control use, physical or psychological problems related to use, experiencing cravings, and/or social or interpersonal problems related to use, including giving up important activities. The data presented below are compiled from the National Survey on Drug Use and Health (NSDUH) and are based on participants' self-report of symptoms that they are experiencing that are consistent with those defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) for either cannabis dependence or abuse (i.e., symptoms of Cannabis Use Disorder). The data below are not based on a formal diagnosis made by a trained health professional. This report presents NSDUH data for these symptoms of cannabis use disorder among the entire Michigan population, as well as among only those that used cannabis in the past year. Tracking these data over time will allow public health providers to understand patterns in potential diagnoses and allocate appropriate resources to populations in need of treatment or prevention efforts, and also monitor how changes in legality effect changes in the rate of possible CUD diagnoses. State-level estimates for Michigan are from the Interactive NSDUH State Estimates website (available at: <https://pdas.samhsa.gov/saes/state>), where data is provided in combined two-year intervals.

FINDINGS

Trends in Self-Reported Past-Year Cannabis Use Disorder in Michigan

Percentage of Individuals with Cannabis Use Disorder in Michigan Over Time

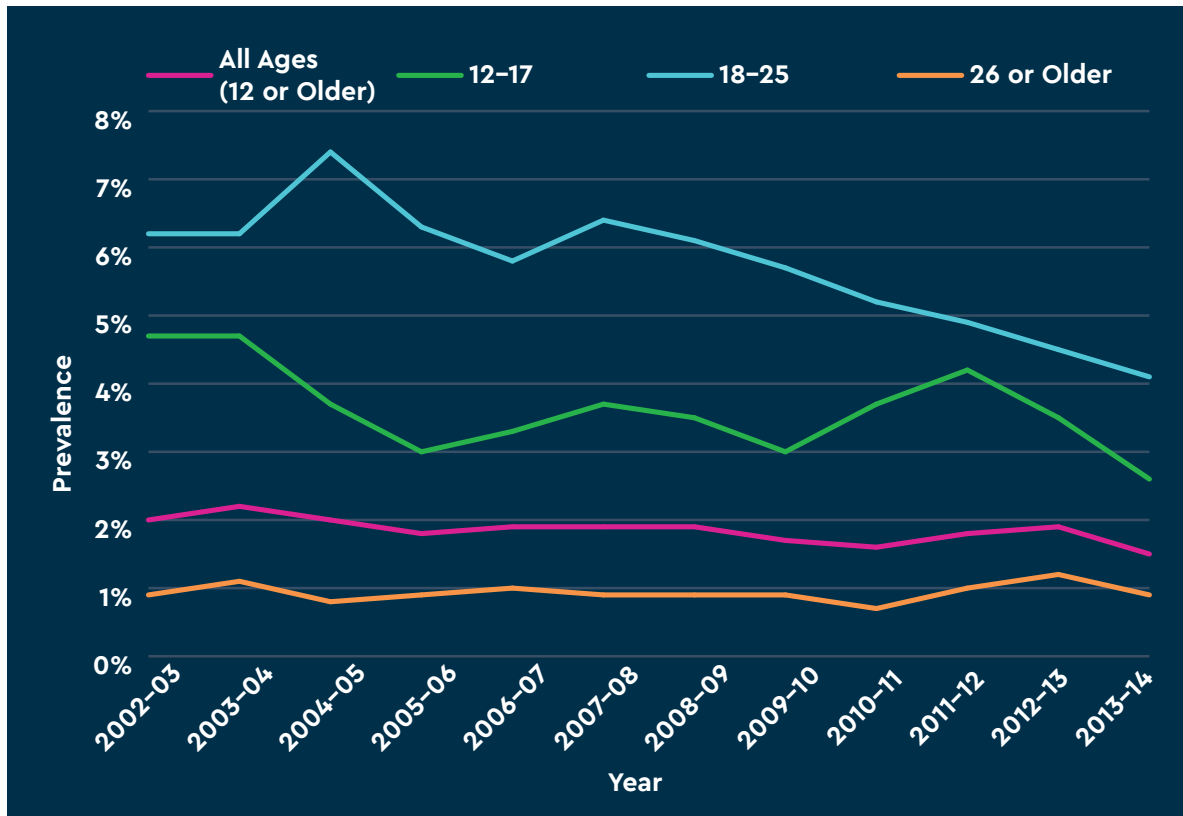


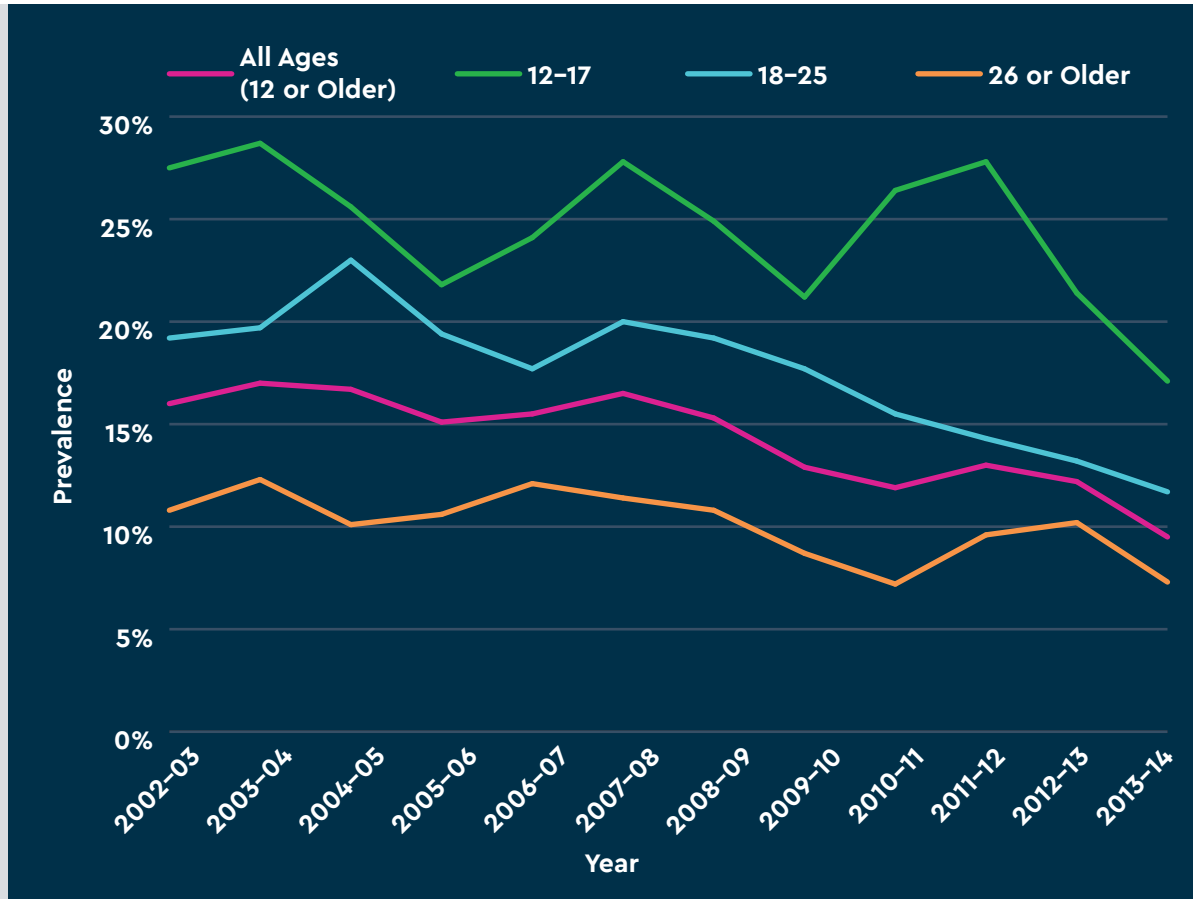
FIGURE 9: Percentage of Past Year Cannabis Abuse and Dependence among All Persons aged ≥ 12 in Michigan, by Age Group

- Overall, the percentage of people experiencing symptoms suggestive of a diagnosis of CUD in Michigan has been relatively consistent at 1.5–2.0% since 2002–2003⁶ (See figure 9).
- There was a 21% decline in this percentage from 2012–2013 to 2013–2014. Further study and additional years of data are needed to understand whether or not this is a consistent trend over time.
- Subpopulations with the highest percentages of individuals with possible CUD include young adults (ages 18–25) and adolescents (ages 12–17), among whom percentages in 2013–2014 were 4.1% and 2.6%, respectively. Overall the percentage of CUD among adolescents (ages 12–17) has decreased 44.7%, while the percentage among young adults has decreased 33.9% since reported in 2002–2003.

Cannabis Use Disorder among Individuals Reporting Past-Year Cannabis Use in Michigan by Age Group

- Among only those reporting cannabis use during the past year, the percentage of individuals reporting symptoms suggestive of a CUD was 9.5% in 2013–2014. This is a 40.6% decrease among this same population observed in 2002–2003 (16.0%).⁶ This decline has predominantly taken place in the years since 2008–2009 (See figure 10).
- While the percentage of individuals with a possible CUD has fluctuated among adolescents (ages 12–17) who use cannabis during the past decade, with decreases in more recent years, there has been a clear and steady decline in the percentage of individuals with CUD symptoms among the young adult (ages 18–25) population, with percentages declining 39.1% from 19.2% in 2002–2003 to 11.7% in 2013–2014.
- Further study is required to develop a more complete understanding of how increasing cannabis use among the general population (in response to legalization of cannabis for both medical and now recreational use) is affecting the overall prevalence of cannabis use disorder among the population of Michigan.

FIGURE 10:
Percentage of Past Year Cannabis Abuse and Dependence among Individuals aged ≥12 in Michigan who report Cannabis Use in the Past Year, by Age Group





CONCLUSIONS

- Among the Michigan residents, the prevalence of symptoms associated with cannabis use disorders has remained relatively stable (1.5–2.0% of the population) between 2002 and 2014, with some evidence of declining percentages among specific subpopulations (ages 12–17 and ages 18–25). This contrasts with the broader trends observed for cannabis use prevalence in Michigan.
- Further data is necessary to provide a conclusive understanding of the findings regarding differences in trends for cannabis use and possible cannabis use disorders. However, such differences might reflect that individuals completing recent surveys may be less likely to accurately report problematic cannabis use when compared with individuals who completed surveys in the past, potentially reflecting changing societal norms regarding problematic use since legalization of cannabis for medical use. Differences could also reflect potential issues with survey items capturing problematic cannabis use in the changing legal landscape (see section on Beliefs about Cannabis Use on page 30). These trends should be examined in more in depth as additional years of data since the legalization of cannabis for medical use become available, and as use patterns potentially change in response to recent legalization for recreational use.

BELIEFS ABOUT CANNABIS USE

INTRODUCTION

This section of the report characterizes beliefs about cannabis use, including public perceptions regarding the risks of cannabis use, public perceptions about the availability of cannabis, and the social acceptability of use. Data presented below characterizes how this has changed over time in Michigan and accounts for changes since the passage of the Michigan medical cannabis law and will be able to be used in future iterations of this report to determine whether and how perceptions of cannabis change following the recent passage of the recreational cannabis law. Such data can reflect changing societal norms and will help guide public health education and messaging campaigns.

FINDINGS

Michigan Trends in Perceptions of Risk and Legal Penalties Associated with Cannabis Use

The following section details an individual's perceptions regarding the risk of cannabis use, what they understand about current legal penalties associated with use, the availability of cannabis, and their beliefs about the social acceptability of cannabis. Data is compiled from the National Survey on Drug Use and Health (NSDUH). By examining these attitudes at the state level, we will be able to observe changes over time. Understanding public opinion (e.g., about the risk of cannabis or about the associated legal penalties) can inform avenues for public health messaging and educational efforts. Further, understanding perceptions of the risk of harm from cannabis use is important as it is a leading indicator of future use.⁷ In this section, a perception of great risk is defined as indicating that smoking cannabis once a month or once to twice a week might cause significant harm to a person, including physical, social, psychological, legal, or vocational harm. Similarly, a perception of no risk is defined as indicating that smoking cannabis once a month or once or twice a week might not cause any harm to a person.⁶ In the section detailing perceptions of legal penalties, data is characterizing perceptions regarding the maximum legal penalty possible for a first-time offender who possessed an ounce or less of cannabis for their own personal use. Potential response options included in the NSDUH survey were a fine, probation, community service, possible prison sentence, mandatory prison sentence, and no penalty.⁶ State-level estimates for Michigan are from the Interactive NSDUH State Estimates website (available at: <https://pdas.samhsa.gov/saes/state>), where data is provided in combined two-year intervals.

Cannabis Risk Perceptions

- Overall, 21.8% of the Michigan population perceived that smoking cannabis once a month will result in a "great risk" of personal harm. This is a 34.2% decline in the percentage of the population that characterized this level of use as posing a "great risk" of harm since 2002-2003 (36.0%)^{5,6} (See figure 11).
- As a group, young adults (ages 18-25 years) had the lowest levels of risk perception when characterized by the percentage of the population reporting cannabis use once a month posed a "great risk" of personal harm. While risk perception appeared to decrease across all subpopulations, this sub-group demonstrated the largest percent reduction in perceived risk over the past 15 years, from 20.3% of the population in 2002-2003 to 9.8% in 2016-2017.
- Among the Michigan population (ages 12 or older), the percentage of the population agreeing with the perception that cannabis use once or twice a week posed a "great risk" of personal harm also declined over the past 15 years from 49.1% in 2002-2003 to 30.4% in 2013-2014.⁶ [Note: Data not shown in graph].

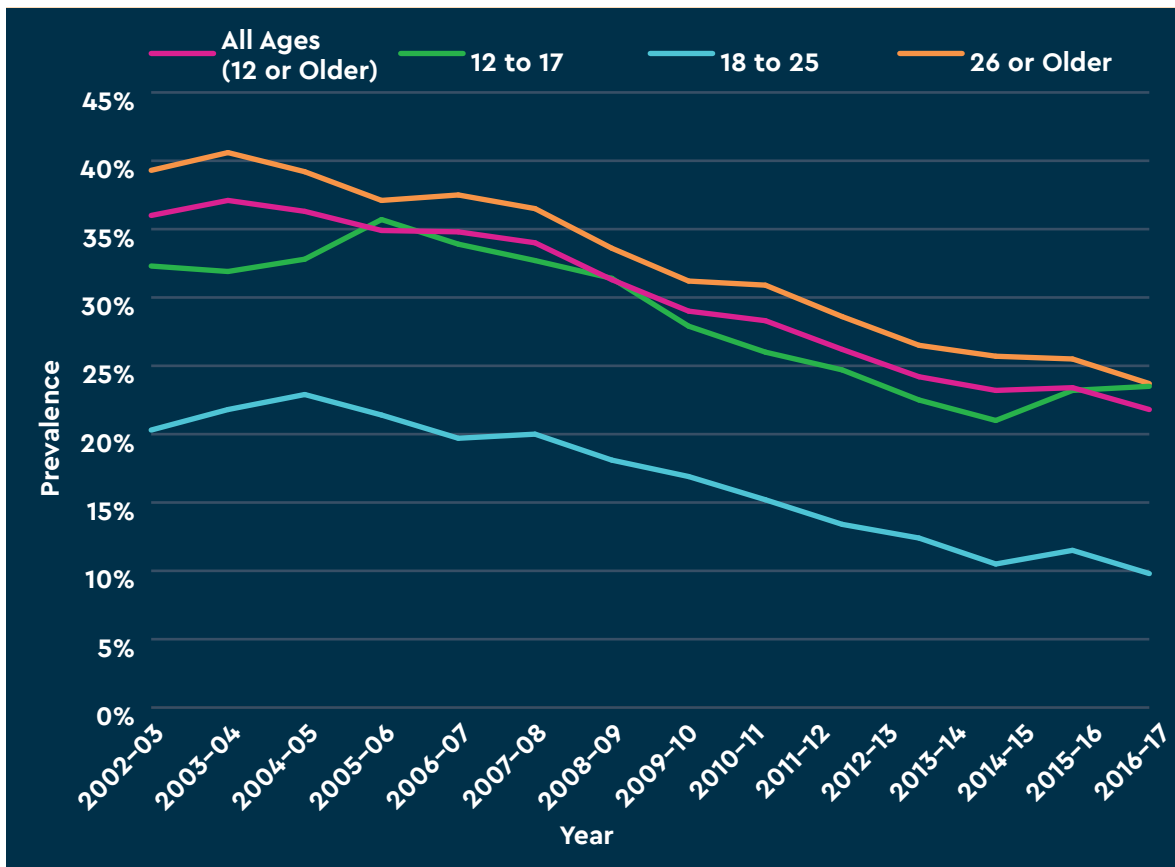
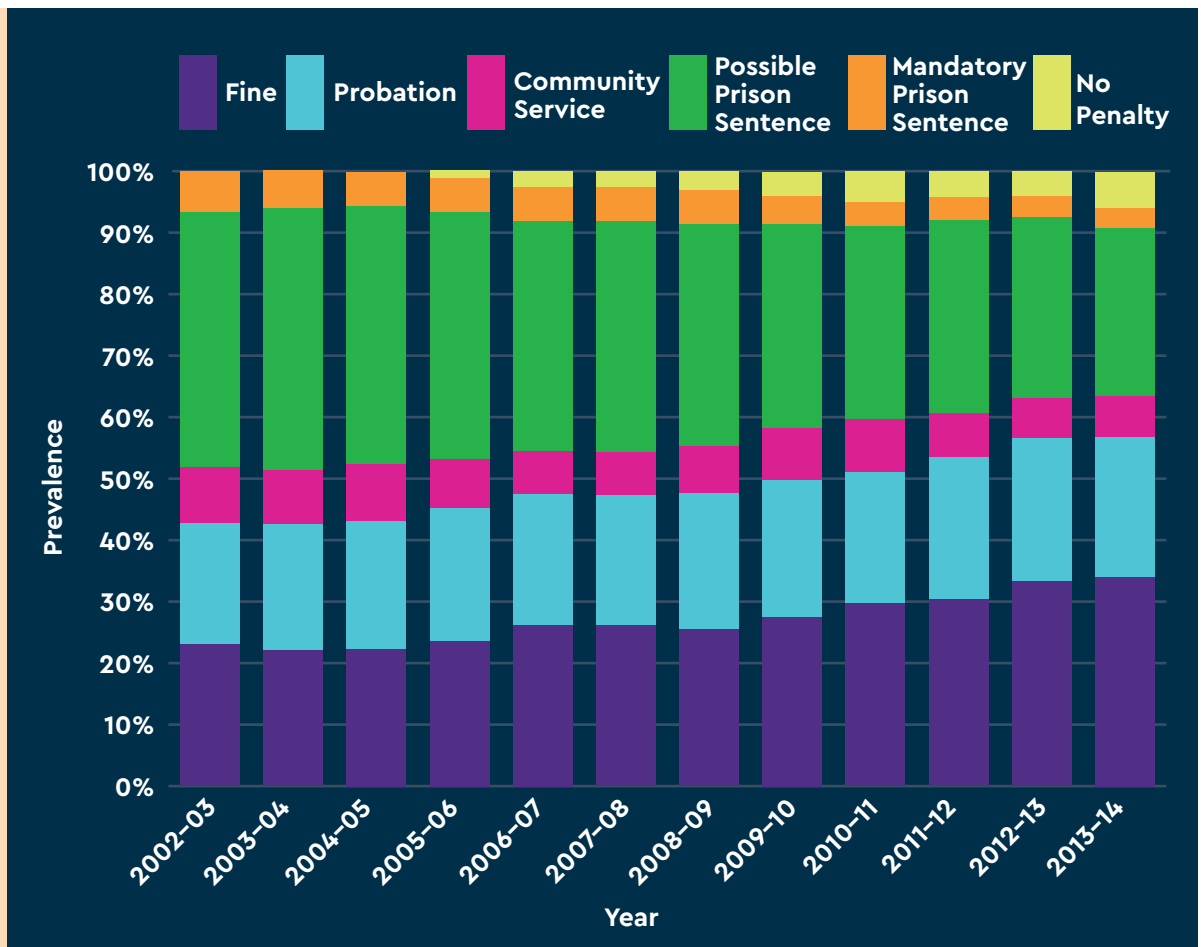


FIGURE 11:
Percentage Perceiving Great Risk from Smoking Cannabis Once a Month among All Persons aged ≥12 in Michigan, by Age Group

Perceptions of Legal Penalties for Cannabis

- In 2013–2014, perceptions among Michigan residents (12 and older) regarding the maximum possible penalty for possession of an ounce or less of cannabis for personal use included a fine (34.0%), possible prison sentence (27.2%), probation (22.7%), community service (6.8%), no penalty (5.8%), and mandatory prison sentence (3.3%)⁶ (See figure 12).
- The perception that there was “no penalty” for cannabis possession has increased from 1.2% in 2005–2006 to 5.8% in 2013–2014.⁶
- The most common perception regarding the maximum legal penalty shifted from receiving a possible prison sentence (in 2011–2012) to receiving a fine (in 2012–2013).⁶

FIGURE 12:
Prevalence
of Different
Perceptions
of the
Maximum
Legal Penalty
in your State
for First
Offense
Possession
of an Ounce
or Less of
Cannabis For
Your Own
Use among
All Persons
aged ≥12 in
Michigan



Perceived Ease of Availability for Cannabis

- The perceived availability of cannabis in Michigan has slightly increased, with those reporting it would be fairly/very easy to obtain cannabis if they wanted it increasing from 62.7% in 2002–2003 to 65.3% in 2013–2014.⁶



Michigan Youth's Beliefs about the Social Acceptability of Cannabis Use

Adolescents (typically defined as aged 12 to 17 years) are in a unique developmental period where their behaviors are influenced by the important individuals in their lives. As adolescents age, their cannabis use can become increasingly affected by their perceptions of their peers' behavior or attitudes (i.e., what they see as the "peer social norm") and less so by their parents' attitudes as they are also spending increased time with peers and less with their parents.⁸ Tracking these markers of social influences on adolescent cannabis use in the context of cannabis policy changes can help identify additional avenues for potential prevention programming (e.g., in schools, with families) to curtail or delay adolescent cannabis initiation as they are at increased risk for negative outcomes with early cannabis exposure.^{9,10}

Perceived Parental Approval

- In 2013–2014 (the most recent year with data available), 95.6% of youth indicated that their parents somewhat or strongly disapproved of them trying cannabis once or twice, and 95.5% also indicated their parents somewhat or strongly disapproved of them using cannabis once a month or more.⁶ Percentages of perceived parental disapproval remained stable from 2002–2003 to 2013–2014.
- In 2013–2014, among adolescents who reported that they have used cannabis during the past month, the percentages of perceived parental disapproval were lower, with 80.9% indicating their parents somewhat or strongly disapproved of them trying cannabis once or twice, and 79.7% indicating their parents somewhat or strongly disapproved of them using cannabis once a month or more.

Disapproval of Peer Cannabis Use

- In 2013–2014, 77.4% of adolescents somewhat or strongly disapproved of their peers trying cannabis once or twice, and 77.6% somewhat or strongly disapproved of peers using cannabis once a month or more.
- Among adolescents reporting they had used cannabis in the past month, percentages of disapproval for peer use were lower, with 31.4% somewhat or strongly disapproving of peers trying cannabis once or twice and 23.0% somewhat or strongly disapproving of peers using cannabis once a month or more.



CONCLUSIONS

- Michigan residents' perceptions regarding the risks of cannabis use have decreased during the past 15 years, with the perception of risk lowest among young adults (ages 18–25), the population with highest percentages of use in the general population of Michigan.
- Perceptions of possible legal penalties have also shifted over the past 15 years, with a higher proportion of the population believing that first-time offenders will receive more lenient penalties (i.e., no penalty or a fine).
- Greater public health messaging that accurately conveys appropriate risks, harms, and potential benefits of cannabis use may be warranted, particularly as the potency of cannabis is rising, which may be associated with increased risk of adverse outcomes.
- The perceived ease of availability for cannabis has increased somewhat over time and may continue to do so given greater legal access in future years.
- Among adolescents, perceptions regarding parental disapproval of cannabis use and disapproval of peer cannabis use have remained stable over time, with the vast majority of adolescents indicating disapproval in both cases. However, prevalence of disapproval was lower among those adolescents reporting cannabis use. Prevention approaches are warranted among this potentially at-risk population, especially given the potential for long-term consequences.

CANNABIS USE AND PREGNANCY

INTRODUCTION

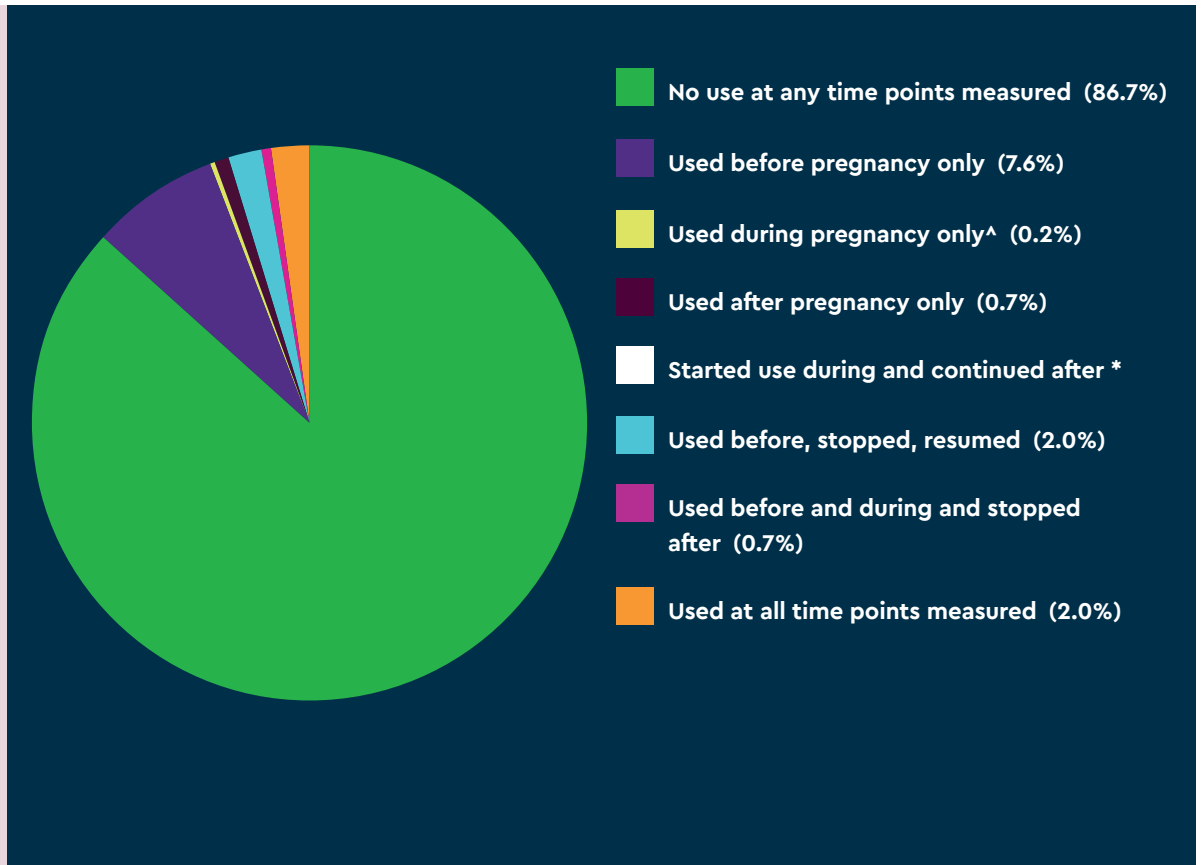
There is growing interest and concern regarding cannabis use among specific population subgroups, including women of childbearing age. Although additional research is needed, these women are of particular concern given potential adverse effects of cannabis use on the developing fetus during pregnancy.^{11,12} Furthermore, maternal use of cannabis post-partum is associated with increased risk for adverse experiences for the developing child.^{13,14} The Michigan Pregnancy Risk Assessment Monitoring System (MI PRAMS) provides unique data regarding cannabis use in and around the perinatal period among mothers giving birth.¹⁵ Specifically, MI PRAMS is an ongoing annual survey of mothers who are Michigan residents and deliver a live-born singleton, twin, or triplet infant in-state. Surveys occur around 11 weeks after childbirth, and responses by mail and phone are pursued until 9 months after childbirth; most survey responses are obtained between 3 and 6 months following childbirth. Cannabis questions were added to the MI PRAMS starting in 2016. In this section, we will review the current data on cannabis use among new mothers in Michigan before pregnancy (12 months before), during pregnancy, and in the immediate time after delivery (since the new baby was born).

FINDINGS

Cannabis Use among Mothers Giving Birth in 2016 and 2017

In 2016 and 2017, the vast majority (86.7%) of Michigan mothers who gave birth did not report using cannabis at any time point (i.e., before, during, or after pregnancy), while approximately 3.0% reported using cannabis at some point during their pregnancy (See figure 13).

FIGURE 13:
Estimated
Percentage
of Cannabis
Use around
the Perinatal
Period among
Michigan
Mothers
Giving Birth
in 2016–2017



[^] Relative Standard Error (RSE) exceeds 30%; interpret with caution.

* Estimate suppressed due to <6 responders or RSE exceeding 50%.



Cannabis Use Before Pregnancy

- In 2016 and 2017, one in eight mothers giving birth (12.4%) reported using cannabis in the twelve months prior to their pregnancy. Pre-pregnancy cannabis use was highest among women under age 20 (24.8%) and decreased with increasing age. Use was lowest in mothers who were over age 35 (8.1%).
- Pre-pregnancy cannabis use was more common among women in the lowest education (21.5% for those who did not complete high school) and income (24.0% for those in households earning less than \$16,000) categories.
- Pre-pregnancy cannabis use was reported by fewer women from higher education and income levels (5.5% for mothers with at least four years of post-high school education; 5.6% for mothers with household incomes greater than \$60,000).
- Women who were unmarried (23.6%) were 4.5 times more likely to report cannabis use before pregnancy compared to women who were married (5.2%).
- Non-Hispanic Black mothers were more likely than mothers from all other race/ethnicity groups to report cannabis use before pregnancy (16.9% vs. 10.9%).

Cannabis Use During Pregnancy

- Approximately one in thirty mothers (~3%) reported using cannabis while pregnant.
- Use during pregnancy was most common for women who were under 30 years of age (4.2%), those that did not complete high school (6.4%), and those with incomes less than \$16,000 (8.8%).
- Women who were not married were four times as likely to use during pregnancy compared to married women (5.6% vs. 1.4%), and non-Hispanic Black mothers were twice as likely to use cannabis while pregnant compared to mothers from all other race/ethnicity groups (5.3% vs. 2.6%).
- Over three-quarters of women who used cannabis before pregnancy did not report using cannabis during pregnancy (77.4%). This proportion of "pregnancy quitters" was consistent for all demographic groups (age, race/ethnicity, education), except that fewer women with pre-pregnancy incomes below \$16,000 reported quitting.
- The vast majority (91%) of mothers reporting cannabis use during pregnancy used it before pregnancy.



Cannabis Use Following Pregnancy

- About one in twenty mothers (4.8%) reported any cannabis use in the months following birth.
- The prevalence of post-pregnancy use was higher among younger women (10.2% under age 20 vs. 3.4% over age 30), and those from lower education (7.7% who did not complete high school vs. 2.3% who completed 4 years or more of post-high school education) and income (9.7% for less than \$24,000 vs. 1.8% for more than \$60,000) categories.
- Non-Hispanic Black mothers were more likely to report any cannabis use following pregnancy compared to mothers from all other race/ethnicity groups (7.0% vs. 4.3%), as were unmarried mothers compared to married mothers (8.3% vs. 2.5%).
- Fewer than 1% of mothers who reported no cannabis use before or during pregnancy reported initiating cannabis in the months following pregnancy.
- Among mothers who quit using cannabis during pregnancy, the majority (79.5%) reported that they did not return to cannabis use in the months following birth.
- About one in five mothers (20.5%) with pre-pregnancy use resumed cannabis use after pregnancy. This was not related to demographic categories.

CONCLUSIONS

- The majority of Michigan mothers who gave birth in 2016 and 2017 did not use cannabis before, during, or after pregnancy.
- The majority of women who used cannabis during pregnancy had used prior to pregnancy; thus, findings may reflect sociodemographic risk factors for cannabis use in general and/or disparities in access to healthcare or prevention-based services. Further work is needed to test these possible associations.
- Although the low prevalence of cannabis use during pregnancy is promising, continued monitoring and education by healthcare systems may be needed to maintain these low percentages, especially in an environment of increased legalization. For example, screening for risk among women planning to become pregnant or in the early stages of pregnancy may be important, followed by interventions and/or referrals for women using cannabis.



CANNABIS USE IN THE MICHIGAN WORKFORCE

INTRODUCTION

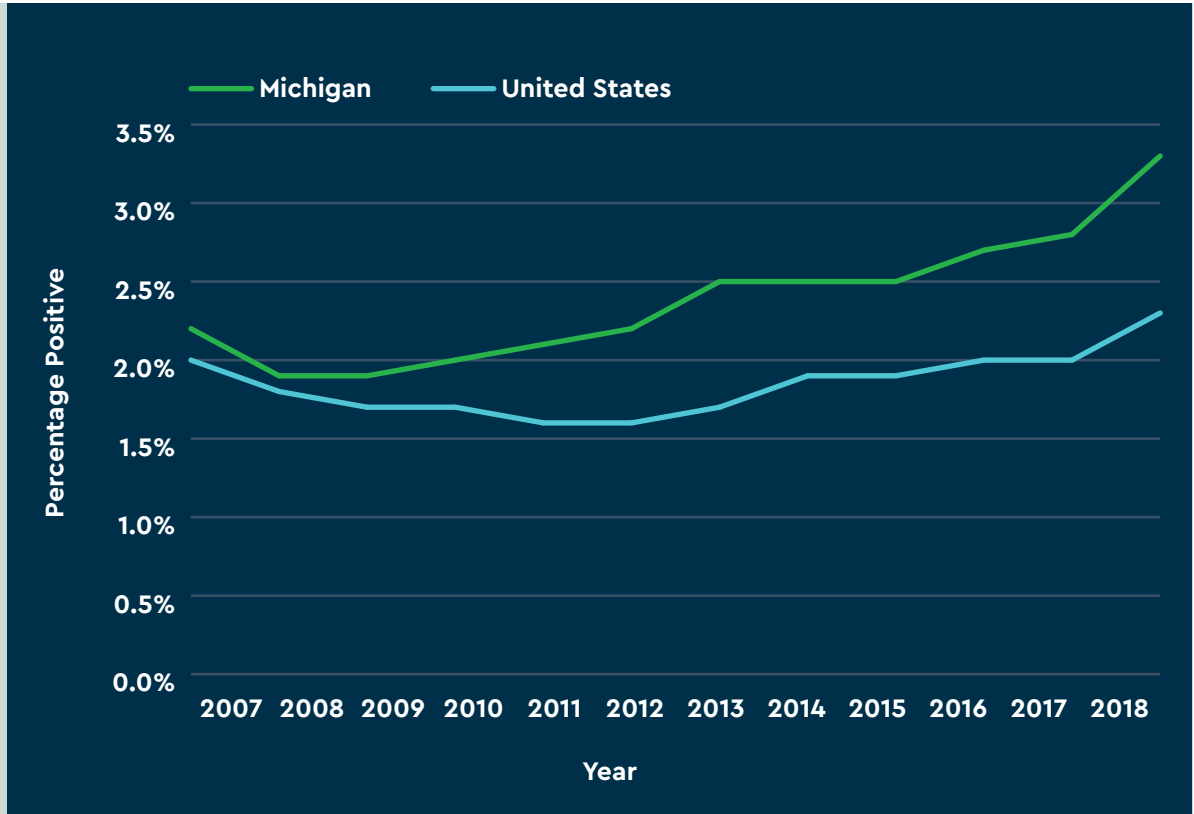
Given that cannabis use may increase risks for workplace-related injury, and has been associated with absenteeism¹⁶ and other negative employment outcomes, cannabis use among the workforce in Michigan is important to gauge and understand, especially with the recent legalization of recreational cannabis use. Results from Quest Diagnostics Drug Testing Index in Michigan are illustrative in this domain; however, it should be noted that these results do not necessarily represent the entire Michigan workforce given that testing is not a uniform practice across all employers. Although thought to generally represent the United States (U.S.) workforce by including federally mandated, safety-sensitive workers and general workforce employees (e.g., 9 million tests in 2018), it should be noted that this dataset is limited to only those workplaces that test employees.^{17,18} Thus, the findings of the following section should be interpreted with caution.

FINDINGS

Comparing Michigan to the U.S.

- The percentage of positive drug tests in workforce testing in Michigan was 3.3% in 2018. Although this overall percentage is small, it represents a 50% increase in the percentage of positive drug tests since 2007, when the percentage was 2.2% within the tested population. Of note, the percentage testing positive in Michigan is higher than the corresponding percentage observed in the U.S. population tested (2.3%), which also observed a smaller increase in this percentage since 2007 (See figure 14).

FIGURE 14:
Percentage of Positive Urine Drug Tests for Cannabis in the Michigan vs. United States' Workforce



CONCLUSIONS

- The percentage of cannabis-positive urine drug tests for Michigan employees, among those that have been tested, is increasing.
- Additional data is needed on workplace policies for hiring potential employees who screen positive for cannabis.
- Further, data is needed regarding policies and procedures used by employee assistance programs for employees who screen positive for cannabis, in terms of assessment for cannabis use disorder and referrals to treatment as indicated.

INTRODUCTION

In November 2008, Michigan voters approved the Michigan Medical Marihuana Act (MMMA), which was effective in December 2008. This law allowed designated patients with a qualifying medical condition or their caregivers to possess a limited amount of cannabis and to grow a limited number of plants. The law did not expressly allow for the operation of medical cannabis dispensaries. In April 2009, the state began accepting applications for registry identification cards, which could be obtained with a certification of a medical condition from a physician. Minors under 18 could obtain medical cannabis with certification from two physicians submitted by a parent consenting to allow the minor to use medical cannabis and the parent agreeing to serve as the caregiver. In 2016, the Michigan Governor signed into law the Medical Marihuana Facilities Act (effective December 2016), which created regulations for the operations of medical dispensaries as well as businesses that grow, transport, test, and process medical cannabis. As policy changes have taken shape, the reporting of relevant data has also been revised [e.g., more recent fiscal year (FY) reports do not contain the number of minors issued a medical cannabis certification].

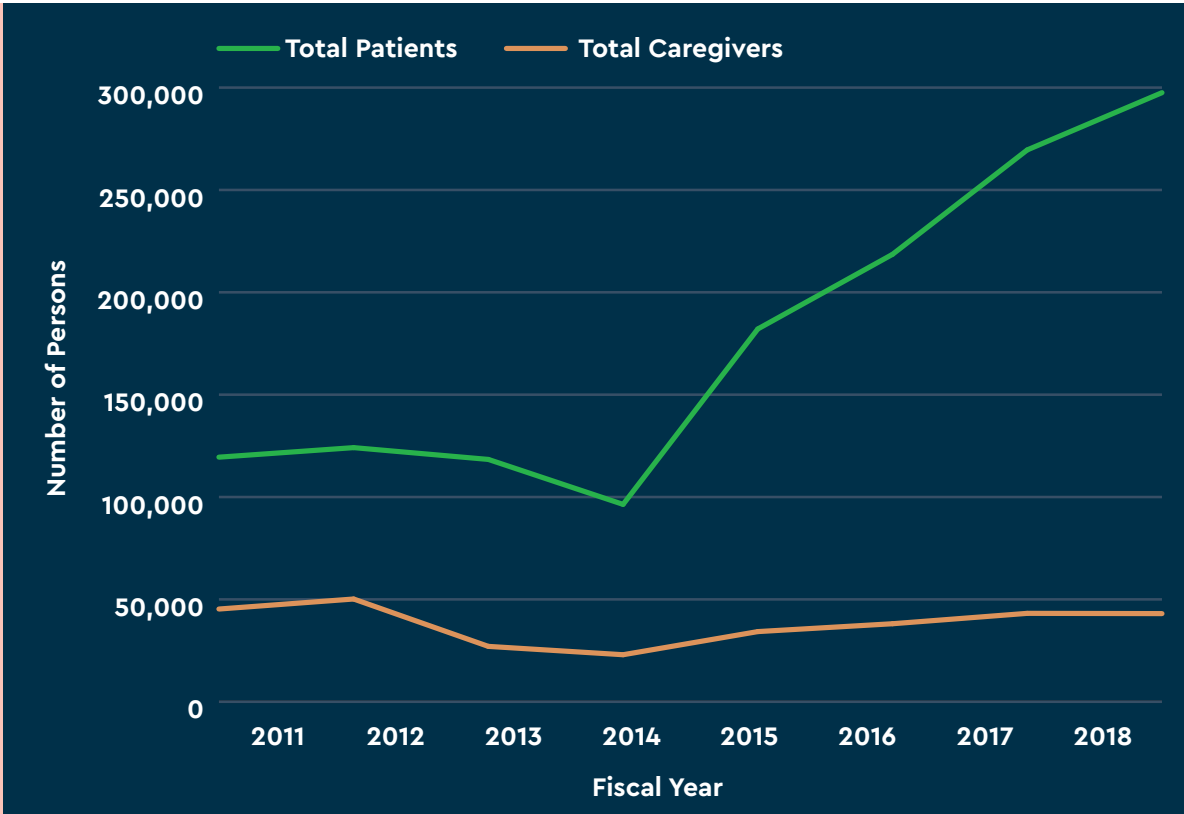
FINDINGS

Patients, Caregivers, and Physicians

- Data from the Michigan Department of Licensing and Regulatory Affairs (LARA)¹⁹⁻²⁶ demonstrate that the number of patients with a medical cannabis certification increased about 2.5 times, from 119,470 in 2011 to 297,515 in 2018, with the majority of those increases occurring after 2014* (See figure 15 on page 42).
- The number of patients in 2018 represents about 3% of the population within the state of Michigan, and along with California and Maine, is among the states with the largest percentage of medical cannabis patients in its population.²⁷
- In 2011 and 2012, there were 63 and 44, respectively, minors who were medical cannabis patients, but these data have not been reported in relevant annual reports since 2012.
- The number of caregivers (e.g., adults at least age 21 or older, who are registered to grow and provide cannabis for identified registered and qualified patients) has fluctuated over the years, with the most recent data (2018) showing that there were a total of 43,056 caregivers registered to grow/provide cannabis for qualified registered patients (See figure 15 on page 42).
- The number of physicians issuing certifications has been somewhat inconsistent but as of 2018 is at 1,818 physicians (See figure 16 on page 42).
- In FY 2018, Wayne and Oakland counties were noted to have the highest number of certifications for patients and caregivers in the state.²⁶

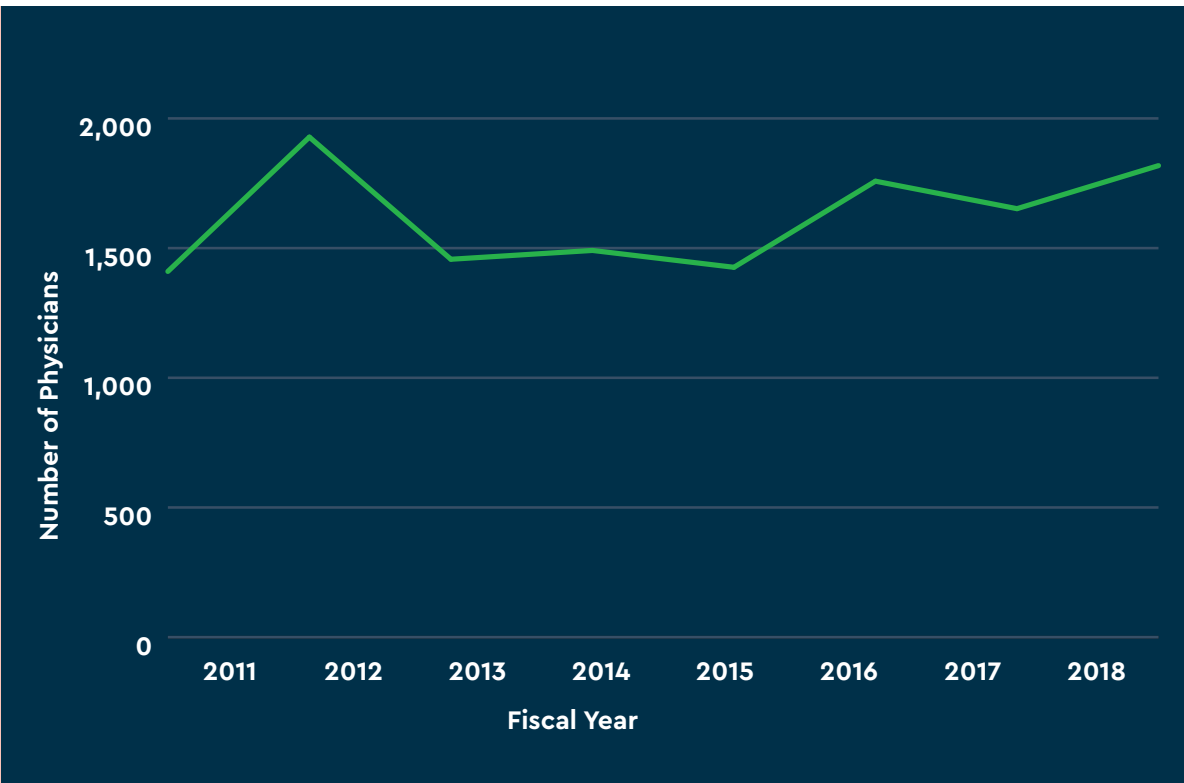
*Note that data from 2009 are excluded because the program began in this year, and data available were from an incomplete fiscal year. Data from 2010 are not available per our communication with LARA.

FIGURE 15:
Total
Number of
Patients and
Caregivers
Holding
Medical
Cannabis
Certifications



*Note that data from 2009 are excluded because the program began in this year, and data available were from an incomplete fiscal year. Data from 2010 are not available per our communication with LARA.

FIGURE 16:
Total Number
of Physicians
Issuing
Medical
Cannabis
Certifications



Qualifying Conditions

- Although there are a number of qualifying medical conditions (with patients allowed to have more than one qualifying condition), the most commonly cited condition is severe and chronic pain, with 91.1% of qualifying patients in 2018 reporting this as their reason for needing medical cannabis* (See figure 17).
- Among other qualifying conditions, severe and persistent muscle spasms are also frequently cited (24.1% in 2018), with severe nausea occurring for 9.5% in 2018.
- Other less commonly cited reasons in 2018 for acquiring medical cannabis were cancer-related pain (4.9%) and post-traumatic stress disorder (4.1%).
- On July 7, 2018, several new conditions were approved by LARA and the Medical Marijuana Review Panel and are now being tracked by the state. Some of these conditions (e.g., rheumatoid arthritis, spinal cord injury) may overlap with previously approved conditions (e.g., severe and chronic pain). Given these changes with more specificity, there may be changes over time in how frequently some of the originally approved qualifying conditions are reported.

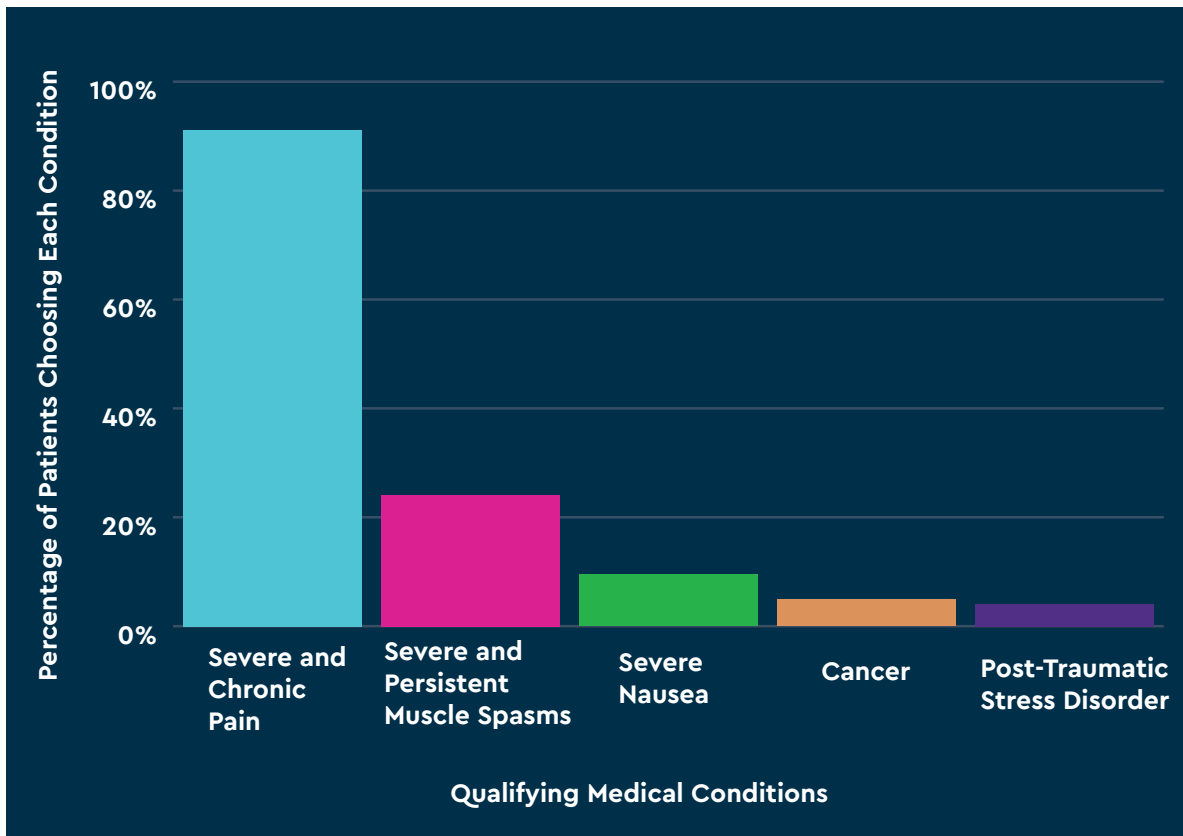


FIGURE 17:
**Qualifying
Medical
Conditions
Most Cited
by Patients
in 2018**

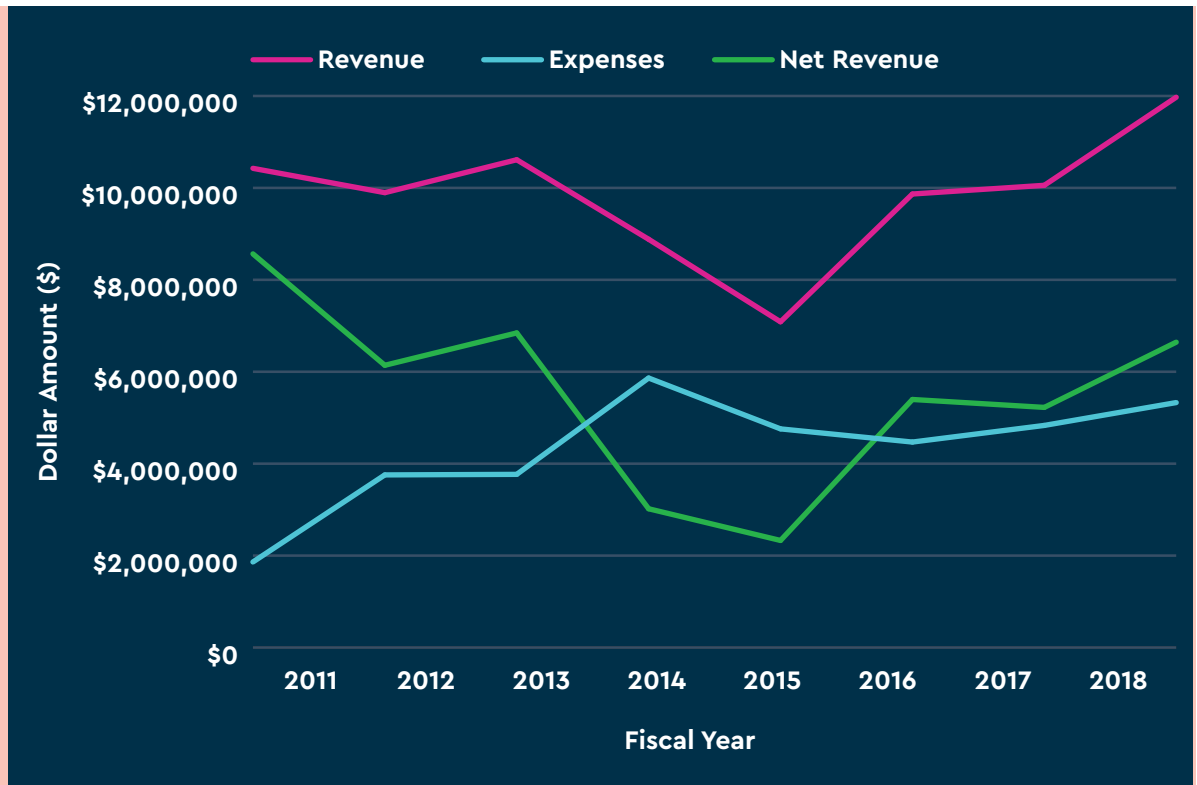
*Note that in addition to "severe and chronic pain," "chronic pain" was also listed as a qualifying condition in 2018, chosen by 4.31% of patients (slightly more than the 4.1% choosing post-traumatic stress disorder). "Chronic pain" is not shown separately in the graph due to the overlap in these two conditions.

Costs Associated with Medical Cannabis Program Administration

Annual state reports provide information on the costs and revenue related to administering the state's medical cannabis program (e.g., processing initial and renewal applications for medical cannabis registry cards). This does not include sales at dispensaries.^{24-26, 28-32}

- While net revenue was lowest in 2014 and 2015 and highest in 2011, the program typically has an annual net revenue of between \$5-7 million (See figure 18).
- In the most recent fiscal year (FY 2018), net revenue was \$6.6 million.

FIGURE 18:
Medical Cannabis Program: Revenue, Expenses, and Net Revenue



New Regulations for Medical Cannabis Facilities

The Medical Marihuana Facilities Licensing Act (MMFLA) is a state licensing program enacted on December 20, 2016. The program began accepting applications in December, 2017. Previously, the legality surrounding medical cannabis allowed for the provision of cannabis within a patient-caregiver relationship in compliance with the 2008 law, but there was no regulatory process for production, transport, facilities, or dispensaries. Only recently has the state program formalized the regulatory process for these components of the Michigan cannabis industry. Currently, five categories of providers are regulated through the MMFLA: growers, provisioning centers (i.e., dispensaries, retail sales), processors, secure transporters, and safety compliance facilities. Those who want to be involved in the cannabis industry must undergo a two-step MMFLA application and approval process, including approval from their local municipality. A facility license is approved for one year and can be renewed annually.



The Michigan Public Policy Survey conducted in Spring 2018 provides some context regarding local support for these new facilities.³³

- 75% of Michigan jurisdictions chose to prohibit medical cannabis facilities, with only 8% opting to allow such facilities in their jurisdiction under the MMFLA.
- Officials from jurisdictions in Southwest Michigan (13%) and the Upper Peninsula (10%) were most likely to report opting in, compared to only 4% of jurisdictions in the Northern Lower Peninsula and West Central Michigan.
- 50% of local officials strongly opposed allowing medical cannabis facilities and few local officials reported having such facilities currently operating.

Licenses and Revenue of the MMFLA

- The MMFLA statistical report for fiscal year (FY) 2018 shows that a total of 766 pre-qualification applications were received (Step 1 of the application process).³⁴ Step 1 involves a background check of applicants and their spouses or anyone co-habiting with them.
- 467 state operating licenses were then received (Step 2 of the application). Step 2 involves passing facility inspections, obtaining building code approvals, and receiving approval for operation by the local municipality.
- 37 license applications were approved in FY 2018 (the majority for provisioning centers); 8 were denied.
- The average amount of time to process a new application was 130 business days.*
- In FY 2018, \$4.6 million was collected from facility license application fees, and \$1.2 million was collected for regular assessments; the total cost for administering the program was \$8.2 million.
- A six-month statistical report (October 1, 2018 to March 31, 2019)³⁵ showed:
 - an additional 79 license applications were approved
 - almost \$9.7 million in revenue was collected during the first quarter
- Data from the Marijuana Enforcement Tracking Reporting & Compliance (METRC) statewide monitoring system for tracking cannabis production (October 1, 2018 to March 31, 2019)³⁵ showed total medical cannabis sales were \$56.4 million, with 11,508 pounds of cannabis sold.
 - The average price of flower was \$174.15 per ounce (median = \$207.63 per ounce).
 - The total revenue collected through the new MMFLA law (e.g., for facility operator licensing fees) in FY 2018 was about \$5.6 million. In the first quarter of FY 2019, \$9.7 million was collected, with costs of administering the program listed as \$4.7 million (it is unclear what time period this cost reflects).

*Note that the licensing program was initially administered by the Michigan Medical Marijuana Licensing Board, until May 2019, when the process transitioned to the Marijuana Regulatory Agency, which is anticipated to more rapidly process applications.



CONCLUSIONS

- The total number of patients with a Michigan medical cannabis certification (currently about 3% of the state population) is increasing, which is expected given the legalization of medical cannabis, increasing eligibility based on newly approved qualifying conditions, and the general trends observed regarding cannabis risk perceptions.
- The vast majority of medical cannabis patients reported severe and chronic pain as a qualifying condition. Given changes in qualifying conditions, there may be changes over time in how frequently some of the originally approved qualifying conditions are reported. This will continue to require further study.
- Thus far, the majority of facility license applications have represented growers and provision centers. Many local officials oppose allowing commercial medical cannabis facilities to operate in their jurisdictions, with the strongest opposition noted in the Northern Lower Peninsula and West Central Michigan regions.
- As the availability of legal recreational cannabis increases, it may be that medical cannabis patients have more options for obtaining cannabis in their communities via medical and recreational retailers (without needing a certification). Thus, the impact of recreational cannabis policy on the state's medical cannabis program remains to be seen and will require further study.

CANNABIS AND THE OPIOID EPIDEMIC

INTRODUCTION

The current U.S. opioid epidemic, which contributed to over 70,000 drug overdose deaths nationwide in 2017³⁶ and 2,053 opioid overdose deaths in Michigan,³⁷ is historically rooted in the over-prescribing of opioids to treat chronic pain. Some have proposed using cannabis as an alternative treatment for chronic pain, and that availability of medical cannabis might contribute to lowering opioid overdose rates.³⁸ In particular, a 2014 ecologic study that compared states with and without medical cannabis laws by Bachhuber et al. helped fuel this speculation.³⁹ That study found that, compared with states without medical cannabis laws, states with medical cannabis laws had lower rates of opioid overdose deaths from 1999 to 2010.³⁹ However, a recent update of the study, published in 2019 by Shover et al. used parallel methods with additional years of data and reported that the original findings did not persist over the longer time period.⁴⁰ In fact, the authors of the latest study found that the association between state medical cannabis laws and opioid overdose deaths reversed direction over time, demonstrating that states with medical cannabis laws actually experienced an increase in overdose deaths.⁴⁰ It is important to note that such studies examining state-level trends do not provide appropriate data for making definitive conclusions about individuals. Due to this limitation, as well as others, Shover et al. concluded, "We find it unlikely that medical cannabis—used by about 2.5% of the U.S. population—has exerted large conflicting effects on opioid overdose mortality. A more plausible interpretation is that this association is spurious."⁴⁰ In this section of the report, data relevant to medical cannabis and opioid overdose deaths in Michigan are reviewed.

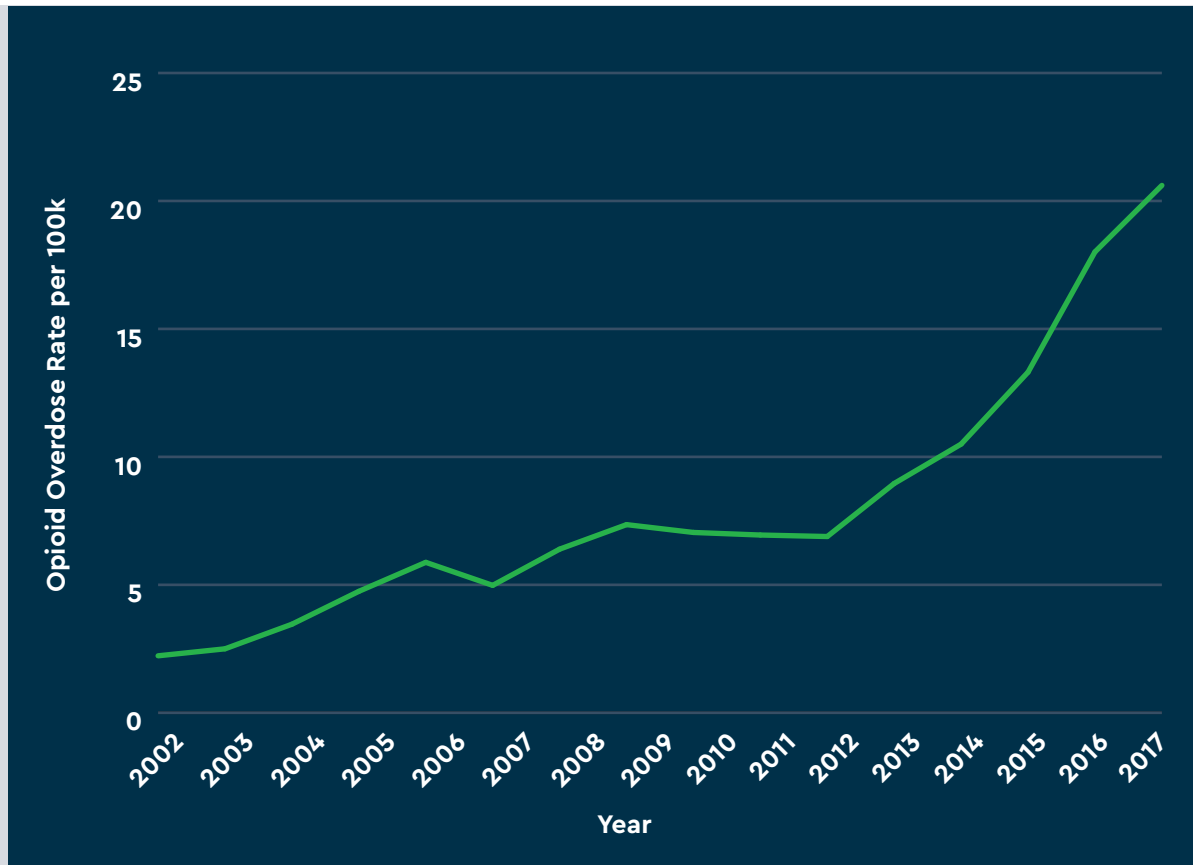
FINDINGS

To first understand the context of the opioid epidemic in Michigan, note the following data, obtained via the Michigan Substance Use Disorder Data Repository:

- According to the Michigan Automated Prescription System (MAPS), the number of opioid prescriptions dispensed increased from 9.7 million in 2013 to more than 10 million per year from 2014–2016.⁴¹ In 2017, the number of opioid prescriptions dispensed returned to below the 2013 level (9.4 million).
- Despite decreasing prescriptions, according to data from Michigan Death Certificates (from the Division for Vital Records and Health Statistics), opioid overdose deaths have been rising in recent years, in part due to increases in heroin and fentanyl use.⁴²

- Data from the Michigan Substance Use Disorder Data Repository shows the overall rate for opioid overdose deaths across all ages in Michigan.
 - Opioid overdose deaths increased 836% from a rate of 2.2 per 100,000 in 2002 to 20.6 per 100,000 residents in 2017⁴² (See figure 19).
 - During the same years (2002–2017) the prevalence of cannabis use was also increasing within Michigan (see page 18).

FIGURE 19:
Opioid
Overdose
Rate per
100K
Residents in
Michigan



CONCLUSIONS

- Based on available information, opioid overdose deaths have been increasing in Michigan during the same time period as cannabis use is increasing.
- Given the lack of individual data and potential confounding factors, these parallel trends should be interpreted with caution, as they may or may not be related to each other. For example, these data are focused on time trends and do not tell us about individuals who were at risk for overdose who may have switched from opioids to cannabis or other options for pain management and avoided overdose.
- Further data are needed, especially to examine both medical and recreational use of cannabis and opioids over time, as well as individual-level associations between cannabis use, opioid use, and adverse consequences such as overdose.

MOTOR VEHICLE CRASHES AND IMPAIRED DRIVING

INTRODUCTION

Since the 1960s, motor vehicle crash (MVC) rates have declined throughout the United States,⁴³ primarily as a result of a broad focus on public health interventions that reduce risk and improve safety (e.g., seat belt laws, graduated driver's license programs, implementation of alcohol interlocks).⁴⁴ Recent changes in cannabis laws that permit recreational use raise concern for the potential impact of these changes on motor vehicle safety and the prevention of crashes due to drug-impaired driving.

Cannabis has been shown in prior research to significantly impair driver judgement, motor coordination, and reaction time.⁴⁵⁻⁵⁰ Further, simulator and test-track studies have identified a direct relationship between the concentration of Tetrahydrocannabinol (THC) in the bloodstream and impaired driving performance.⁴⁸⁻⁵⁰ However, studies on the relationship of cannabis to motor vehicle crash risk remain mixed.^{51,52} While cannabis is the illicit drug most commonly found in the bloodstream of drivers involved in MVCs, including fatal motor vehicle crashes,⁵³ cannabis is also able to be detected in the body for several weeks after use and because it is frequently combined with alcohol, it has been difficult to directly understand the effect of cannabis on crash risk independent of these other factors. Regardless, the risk of combining alcohol and cannabis does appear to increase crash risk relative to use of either drug by itself.⁴⁹ Additional studies to further clarify the role of cannabis, including different types of consumption (e.g., high potency dabs, edibles), on acute and long-term driving-related impairment and crash risk are still needed to fully understand this public health concern, especially in light of the changing legal landscape. This section of the report reviews what is known about the role of cannabis in fatal MVCs in Michigan, as well as rates of cannabis-impaired driving among medical cannabis patients to establish a baseline of understanding for Michigan in the context of recreational legalization.

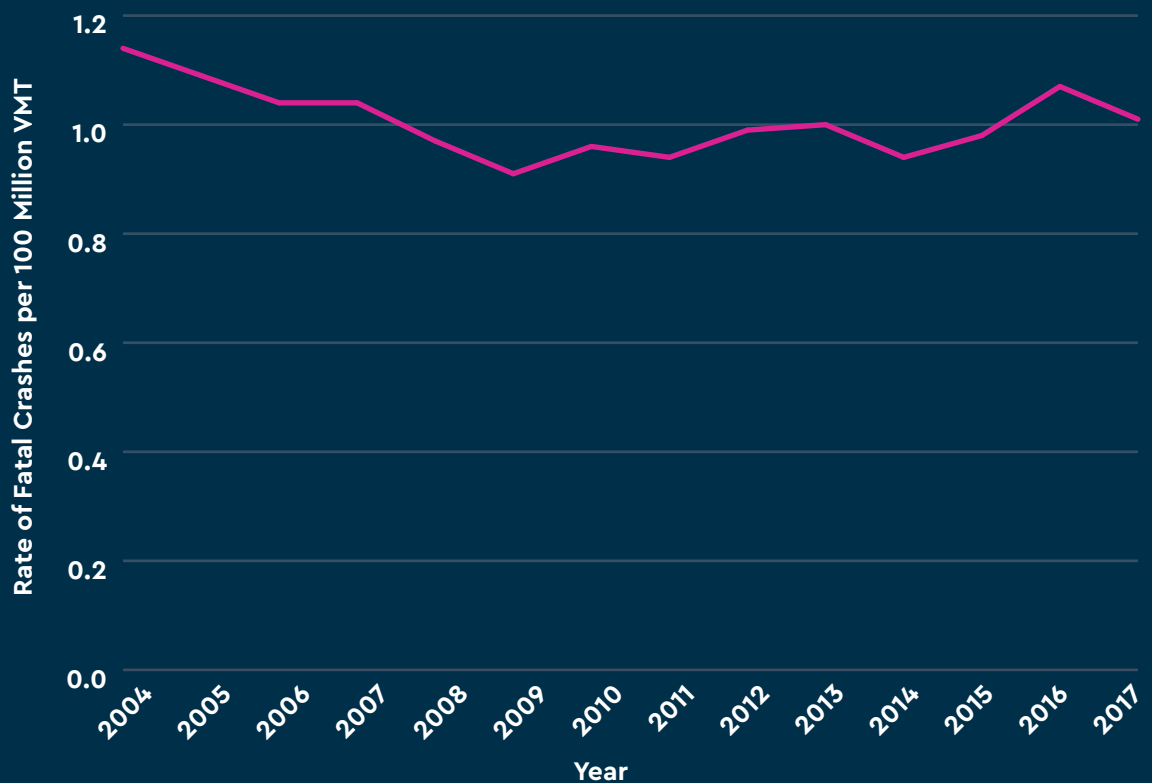
FINDINGS

Fatal Motor Vehicle Crashes in Michigan

The role of cannabis in motor vehicle crashes in Michigan can be partially understood using statewide crash data from the Michigan Traffic Crash Facts (MTCF) website⁵⁴ and the Fatality Analysis Reporting System (FARS)⁵⁵ data, including overall rates of annual fatal motor vehicle crashes, the number of crash-involved drivers that were tested for drugs following the crash and, among those, the number that tested positive for cannabinoids.

- The rate of annual fatal crashes per 100 million vehicle miles traveled (VMT) has decreased 11.4% over the last 13 years of available data from 1.14 in 2004 to 1.01 in 2017⁵⁴ (See figure 20).
- Although crashes have reduced during this time period, the number of drug tests administered in fatal crashes has increased. The rate of toxicology testing has nearly doubled from 2004 (23.2%) to 2017 (40.6%).⁵⁵
- Among those tested, the proportion of tests that were positive for cannabinoids more than tripled, rising from 6.7% in 2004 to 23.4% in 2017⁵⁵ (See figure 21).

FIGURE 20:
Rate of
Annual Fatal
Motor Vehicle
Crashes in
Michigan



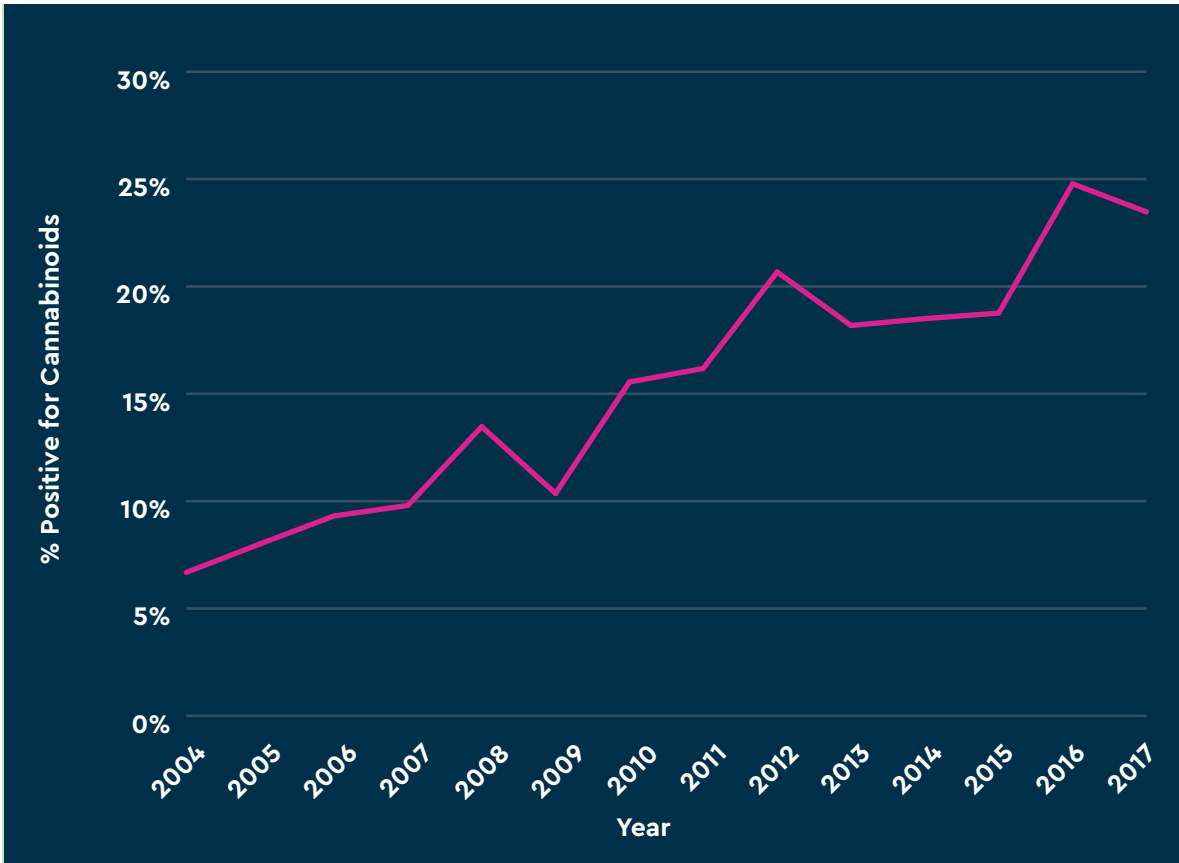


FIGURE 21:
Percentage of Tested Drivers in Fatal Crashes in Michigan who Tested Positive for Cannabinoid Drugs

Driving Under the Influence among Michigan Medical Cannabis Patients

Data is lacking pertaining to other indicators of cannabis-impaired driving at the state level; however, one 2019 study⁵⁶ sheds light on the extent of cannabis-impaired driving among Michigan medical cannabis patients seeking new or renewal certifications for chronic pain (the most common reason for seeking medical cannabis). Patients (N=790) from three certification centers (66% seeking renewal certification) reported on their individual driving behaviors for the six months prior to completing the survey.

- 56.4% reported driving within two hours of cannabis use, 50.5% reported driving while being "a little high," and 21.1% reported driving while feeling "very high."
- Driving after cannabis use was also noted to be a frequent behavior among those surveyed. In the past 6 months, 21.6% reported driving 10+ times within two hours of cannabis use, 18.7% drove 10+ times while they were "a little high," and 7.2% drove 10+ times while they were "very high."
- Binge drinking and higher amounts of cannabis consumed were found to be associated with an increased odds of reporting these driving behaviors.



CONCLUSIONS

- While the annual fatal MVC rate in Michigan has been decreasing, the number of drug tests administered and the percentage of cannabis-involved fatal crashes has been increasing, underscoring the need for public health approaches to prevent operating vehicles under the influence of cannabis.
- Increased and more consistent testing in fatal and non-fatal MVC and other traffic incidents is needed to better characterize the involvement or lack thereof of cannabis in various driving-related outcomes.
- Reliable testing methods to determine cannabis impairment among drivers at the time of a crash or traffic incident are also needed.

CANNABIS-RELATED MORTALITY

INTRODUCTION

The following section provides data on cannabis as a cause of death among Michigan residents. While cannabis as a primary cause of death has not been extensively documented, heavy use in the setting of underlying severe medical conditions (e.g., atherosclerotic disease, cancer) may result in cannabis serving as a contributing factor for fatal health outcomes.⁵⁷⁻⁵⁹ A recent review paper⁵⁸ identified six case studies documenting 13 patients where recent cannabis use was linked directly to fatal cardiac outcomes (e.g., sudden cardiac death following recent cannabis use), with the majority of cases finding the patients had an underlying cardiac diagnoses or abnormality at autopsy (e.g., prior heart attack, coronary artery disease, prior arrhythmia history). Another case series has recently identified a series of deaths in patients with cannabinoid hyperemesis syndrome (i.e., cyclical nausea and vomiting), with most deaths resulting from electrolyte abnormalities and/or renal failure.⁵⁹ Available data for the State of Michigan focuses on cannabis poisoning as a primary cause of death (e.g., symptoms that can include: rapid heartbeat, hallucinations, confusion, panic, anxiety, and/or extreme paranoia)⁶⁰ and is documented in the following section.

FINDINGS

- Mortality data from all deaths occurring in Michigan from 2004–2017 are contained in the Michigan Resident Death File.⁶¹
- Cannabis poisoning was recorded as a primary cause of death for fewer than 6 deaths between 2004–2017 out of a total of 1,272,204 deaths during that entire time period.
- Cannabis poisoning was recorded as related to the cause of death for 45 total deaths during the same time period.

CONCLUSIONS

- Cannabis poisoning as the primary cause of death is extremely rare, and is only slightly higher when examined as a related to the cause of death.
- Improved efforts are needed for tracking cannabis-involvement in deaths via more uniform toxicology testing.

SUICIDES AND HOMICIDES

INTRODUCTION

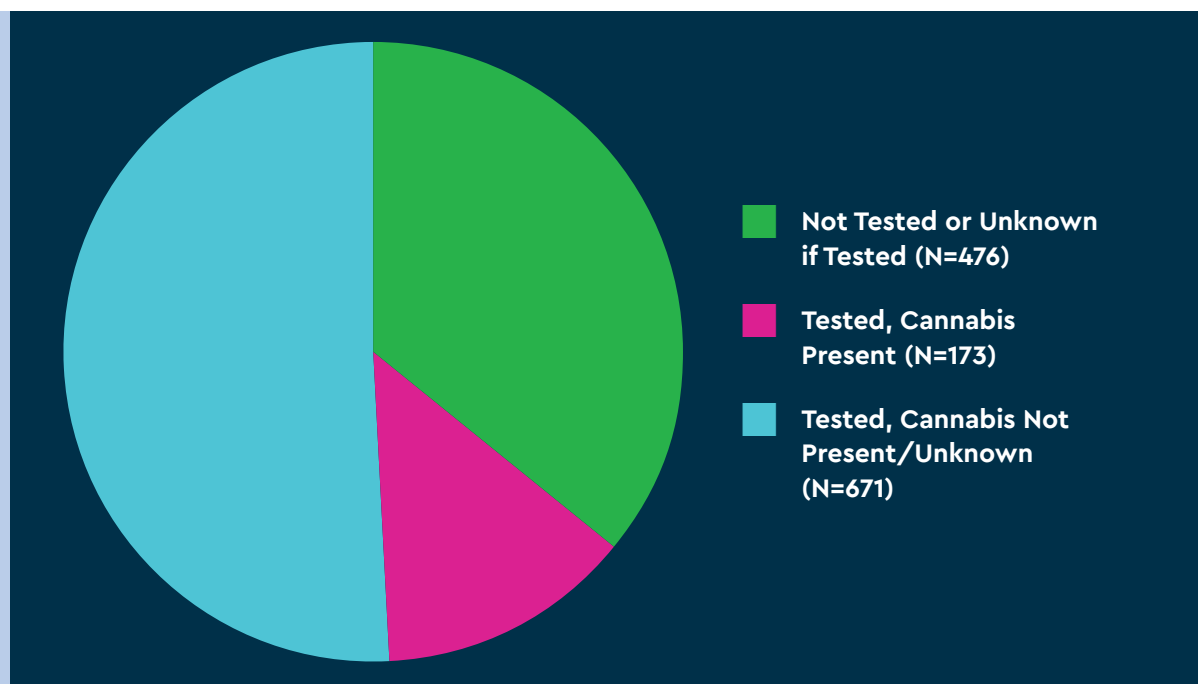
The following section provides information on cannabis as it relates to violent deaths (i.e., suicides, homicides). Prior research has documented some links between cannabis consumption and an increased risk for suicide,⁶² whereas data regarding the relationship of cannabis with homicide death is less clear.⁶³ Data on violent death come from the Michigan Violent Death Reporting System (MiVDRS),⁶⁴⁻⁶⁶ which follows the CDC definition of violent death used by all states for the National Violent Death Reporting System (NVDRS). This section presents data on findings for cannabis on toxicology testing among Michigan suicide and homicide deaths. It is important to note that the presence of cannabis at the time of death does not provide any causal evidence regarding cannabis as a contributor to homicide or suicide outcomes.

FINDINGS

Cannabis Testing Results for Michigan Suicide Deaths in 2016

- In 2016, there were a total of 1,320 suicide deaths in Michigan (See figure 22).
- Of these, 67.0% (n=885) had any toxicological information, with 95.3% (n=844) of those containing information about cannabis toxicology specifically.
- 20.5% of the 844 tested cases were positive for cannabis.
- In 2016, males comprised 77.9% (n=1,029) of all suicide deaths in Michigan. Among the 636 male suicide decedents who were tested for cannabis, 22.2% tested positive. With respect to female decedents (n=291), among the 211 who were tested for cannabis, 15.2% tested positive.
- Among suicide decedents, 79.2% of adolescents (12–17 year-olds), 62.9% of young adults (18–25 year-olds), and 63.3% of adults over age 25 were tested for cannabis. Of those tested, 16.7% of adolescents, 40% of young adults, and 17.7% of adults over age 25 were positive for cannabis.

FIGURE 22:
Cannabis
Testing
in Suicide
Deaths in
Michigan
in 2016
(N=1,320)



Cannabis Testing Results for Michigan Homicide Deaths in 2016

- In 2016, there were 616 homicides (including resulting from legal intervention) in Michigan among people aged 12 years and older (See figure 23). Medical examiner case files are available for 570 (92.5%) of these cases with 514 (90.2%) reporting toxicology findings.
- 499 cases with toxicology reports were tested for cannabis, with 53.9% testing positive for cannabis.
- Males accounted for 79.4% (n= 489) of the homicide deaths. Out of the 400 males with toxicological testing on cannabis, 60.3% tested positive for cannabis. Among females, 126 died as a result of homicide in 2016. Among the 99 females (78.6%) tested for cannabis, 28.3% tested positive for cannabis.
- Among homicide decedents, 83.8% of young adults (18–25 year-olds) and 80.0% of adults over age 25 were tested for cannabis. Out of those tested for cannabis, 70.0% of young adults and 50.3% of adults over age 25 tested positive for cannabis. (We note that due to small numbers, subgroup reporting for adolescents was not advised.)

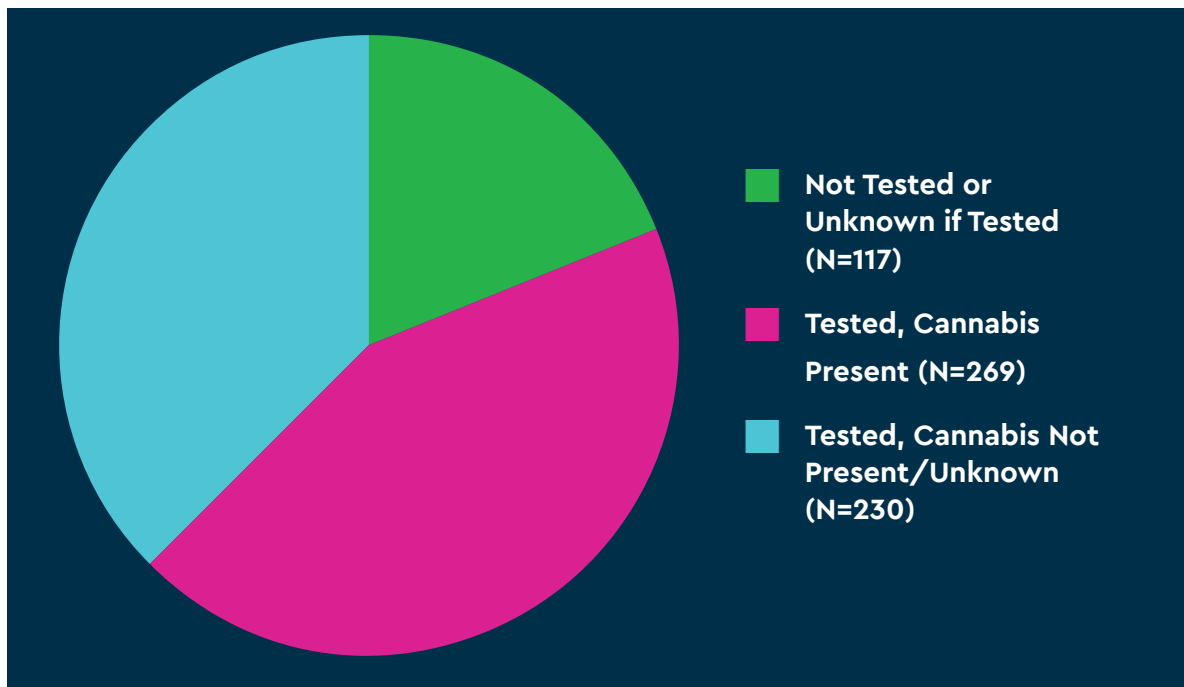


FIGURE 23:
Cannabis Testing in Homicide Deaths in Michigan in 2016 (N=616)

CONCLUSIONS

- Toxicology testing among suicide and homicide decedents shows a marked prevalence of cannabis use, namely about one in five suicides and about half of homicides, and was particularly common among males and young adults.
- Although the causes of suicide and homicide are complex, suicide and violence prevention programs could potentially benefit from addressing cannabis use to help mitigate risk.

HEALTHCARE UTILIZATION

INTRODUCTION

Given the prior state-level legalization of cannabis for approved medical conditions in 2008 and the more recent legalization of recreational cannabis in 2018, coupled with trends showing the rising prevalence of cannabis use in Michigan, there are concerns about the potential for adverse health effects among Michigan's citizens. Emergency department (ED) visits and inpatient hospitalizations are important indicators of the acute health consequences experienced by those who use cannabis and are critical to track over time with the changes in cannabis legislation. Cannabis-related ED visits have been noted to be increasing nationally, with the largest increases among adolescent (12–17 years) populations.⁶⁷ In addition, cannabis use disorder (CUD) is a potential consequence of ongoing cannabis use for some individuals. Substance use disorder treatment utilization data can provide an indicator of the scope of CUD in the treatment system, although treatment rates for individuals with CUD are generally low.⁶⁸ The following sections provide an overview of the limited information that is available in Michigan regarding indicators of cannabis-related healthcare utilization.

FINDINGS

Emergency Department Visits

Emergency Department (ED) data has been compiled from the Michigan Outpatient Database (MODB)⁶⁹ at Michigan Health and Hospital Association-member (MHA) acute-care hospitals. The Michigan Health and Hospital Association is the statewide leader representing all community hospitals across Michigan. The MODB catalogs all healthcare visits discharged from the ED at Michigan Health and Hospital Association-member acute-care hospitals located in Michigan, which cover approximately 89–91% of all hospitals in the state. The MODB includes patient demographic information as well as diagnosis and procedure codes associated with each visit. Rates of cannabis-related diagnoses among ED patients seeking care at Michigan hospitals in 2016 and 2017 are presented on the next page.

Adverse effects of cannabis use include undesirable symptoms related to acute toxicity, including mild anxiety, agitation, decreased coordination, slowed reaction time, nausea, and lethargy. These symptoms exist on a spectrum with cannabis poisoning, which is characterized by more severe toxicity symptoms, including mental status changes (e.g., delirium, delusions, hallucinations), amnesia, agitation, problems with coordination and reaction time, decreased steadiness, slurred speech, tachycardia, and nausea/vomiting.⁷⁰ The data below includes ED visits with a diagnosis of adverse effects related to cannabis use. This is followed by data demonstrating ED visits with a diagnosis of cannabis poisoning that resulted from intentional (self-harm), unintentional (accidental), assault, and undetermined mechanisms. Note that adverse cannabis effects and cannabis poisoning are specific diagnoses and clinicians may use more generic diagnoses to describe underlying symptoms (e.g., vomiting, mental status changes) associated with toxicity. Thus, rates of ED visits related to adverse effects of cannabis may be an underestimate. Note that rates in this section of the report are calculated as the rate of ED visit per 100,000 people in the general Michigan population.

Adverse Effects of Cannabis Use

- In Michigan, ED visits with a diagnosis of adverse effects related to cannabis use increased from 1.8 to 2.9 per 100,000 persons from 2016 to 2017 (See figure 24).
- In 2016, people aged 15–24 years accounted for the largest percentage of ED visits where adverse effects of cannabis was listed as a diagnosis (37.0%); but in 2017, people aged 25–34 years comprised the highest percentage (33.1%).
- Males were responsible for 60.2% of ED visits in 2016 and 53.4% in 2017 where adverse effects of cannabis use comprised a diagnosis.

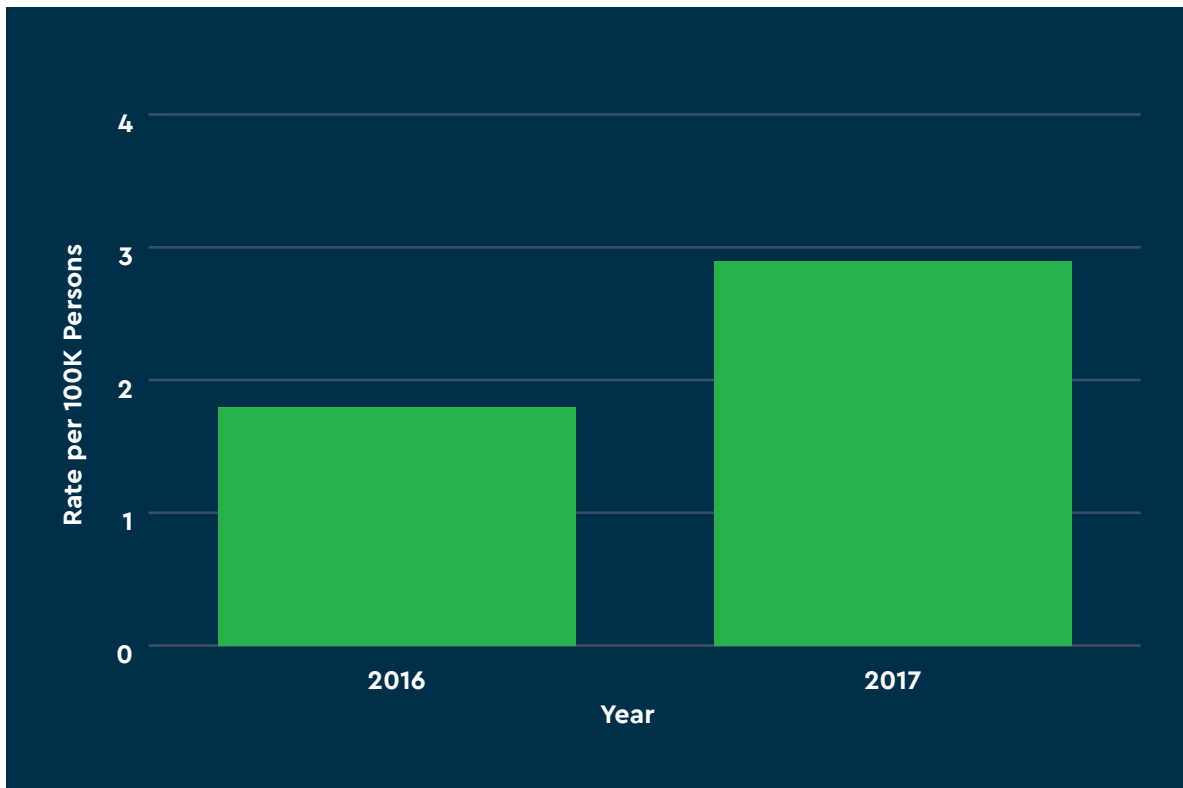
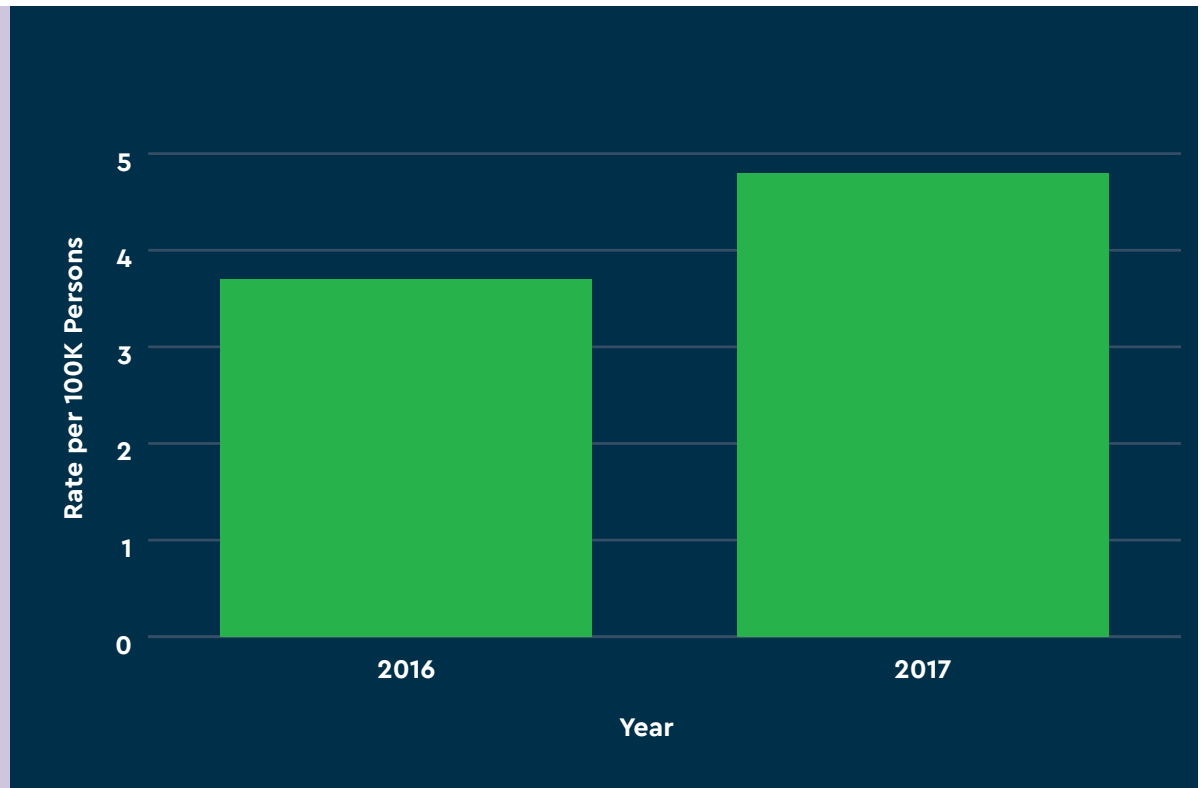


FIGURE 24:
Rates of
ED Visits
Involving
Adverse
Effects of
Cannabis Use
as Any Listed
Diagnosis

Cannabis Poisoning

- In Michigan, ED visits with the diagnosis of cannabis poisoning increased 29.7% from 3.7 per 100,000 persons in 2016 to 4.8 per 100,000 in 2017 (See figure 25).
- Young adults aged 15–24 years comprised the largest proportion of ED visits where cannabis poisoning was included as a diagnosis (2016: 34.9%; 2017: 33.3%).
- Males were responsible for 55.1% of ED visits in 2016 and 52.7% of ED visits in 2017 where cannabis poisoning was a diagnosis.

FIGURE 25:
Rates of ED
Visits Involving
Cannabis
Poisoning as
Any Listed
Diagnosis



Cannabis-related Disorders

- Cannabis-related disorders diagnosed at the time of a Michigan ED visit reflect cannabis abuse and dependence (i.e., cannabis use disorders) as well as cannabis use, in general, with or without associated complications (e.g., acute intoxication, psychological impairment).
- In Michigan, ED visits with the diagnosis of a cannabis-related disorder, increased 4.0% from 312.3 to 324.8 per 100,000 persons from 2016 to 2017, respectively (See figure 26).
- Adults aged 25–34 years comprised the largest proportion of ED visits where a cannabis-related disorder was included as a diagnosis (2016: 27.6%; 2017: 28.5%).
- Males accounted for 58.0% of ED visits in 2016 and 57.3% in 2017 where cannabis-related disorders comprised a diagnosis.

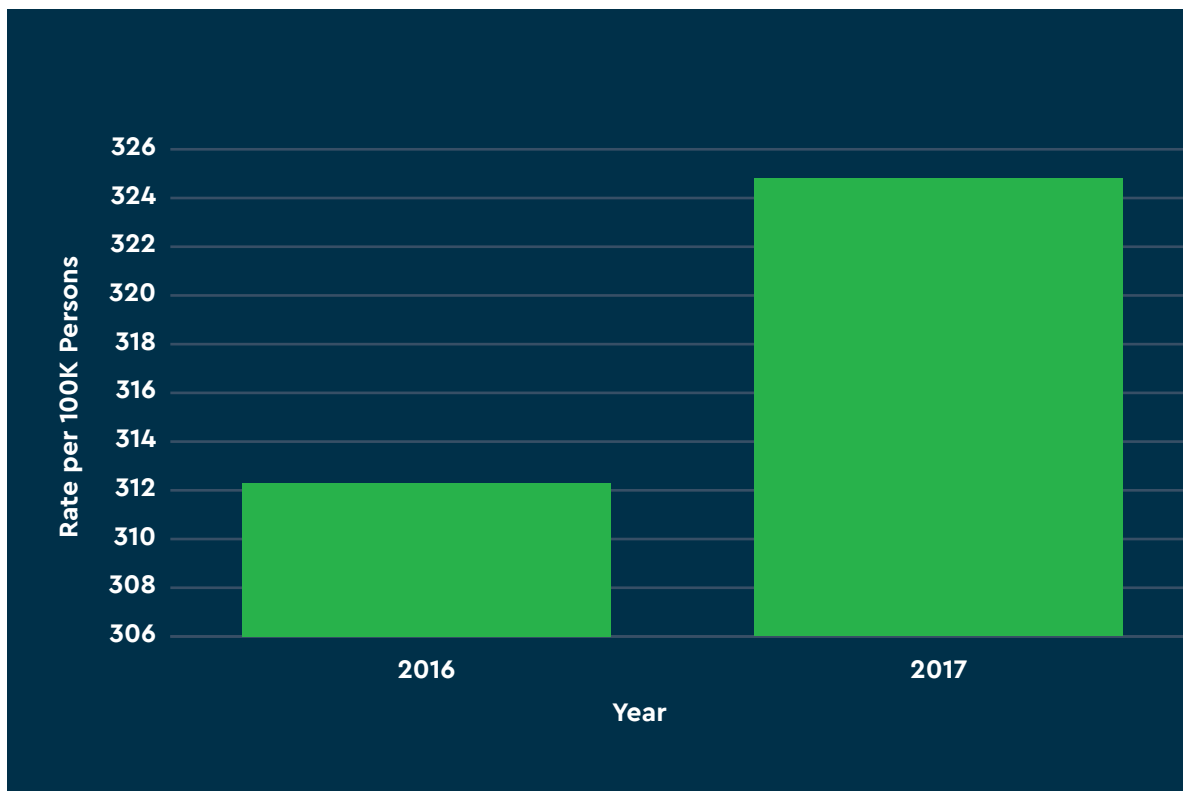


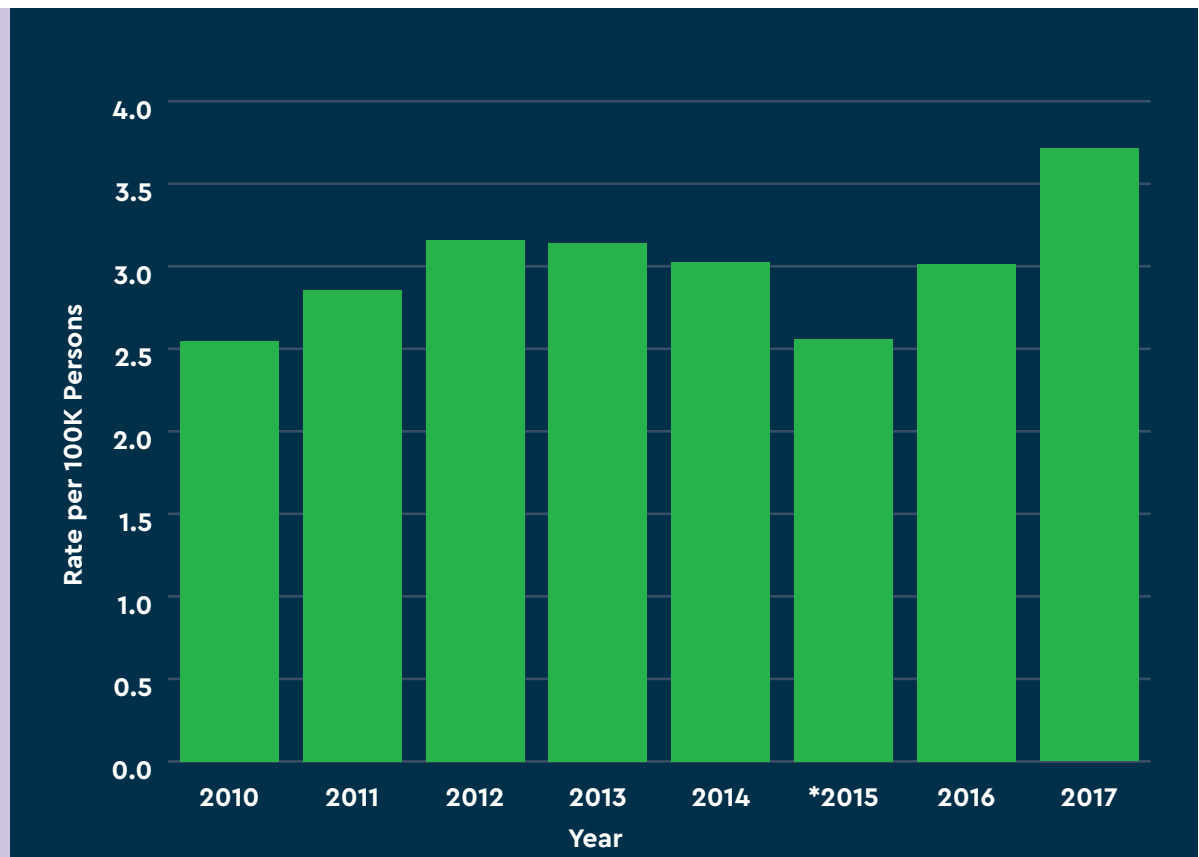
FIGURE 26:
Rates of ED
Visits Involving
Cannabis-
related
Disorders as
Any Listed
Diagnosis

Inpatient Hospitalizations

Michigan hospitalization data obtained from the Michigan Inpatient Database (MIDB)⁷¹ includes all inpatient hospital admissions from 2010 to 2017 at Michigan Health and Hospital Association-member hospitals. The MIDB catalogs all inpatient hospital admissions at MHA-member hospitals located in Michigan, which comprises approximately 94–95% of all hospitalizations statewide. The MIDB includes patient demographic information as well as diagnosis and procedure codes associated with each inpatient visit. We describe the rates below for various cannabis-related diagnoses given to inpatient hospitalizations. However, caution is warranted in interpreting rates prior to and after 2015, as any observed changes may have been impacted by the transition in the International Classification of Diseases (ICD) coding system.

- The data presented below includes hospitalizations resulting from a diagnosis of cannabis poisoning, including those resulting from intentional (self-harm), unintentional (accidental), assault, and undetermined injury-related mechanisms.
- Rates of hospitalization for cannabis poisoning (as any listed diagnosis) were lowest in 2010 (i.e., 2.5 per 100,000 persons) and highest in 2017 (i.e., 3.7 per 100,000 persons); rates increased from 2010 (2.5 per 100,000) to 2012 (3.1 per 100,000), decreased over the next few years to 2.5 per 100,000 in 2015, and increased nearly 1.5 times by 2017 (3.7 per 100,000) (See figure 27). However, changes from 2015 onward may be affected by transition of the ICD system in 2015.
- Youth aged 15–24 years (29.6%) and males (59.7%) made up the largest proportion of these hospitalizations.

FIGURE 27:
Rates of
Inpatient
Hospitalizations
Involving
Cannabis
Poisoning as
Any Listed
Diagnosis



*The transition to the new ICD coding system occurred in 2015.

- Inpatient hospitalizations with a cannabis-related disorder as any listed diagnosis can reflect cannabis abuse and dependence (i.e., cannabis use disorders) as well as cannabis use with or without an associated complication (e.g., acute intoxication, psychological impairment).
- The rate of inpatient hospitalizations involving cannabis-related disorders nearly doubled from 2010 (206.4 per 100,000 persons) to 2017 (407.0 per 100,000 persons) (See figure 28).
- Males and adults aged 25–34 years comprised the largest proportion of people who had hospitalizations each year involving cannabis-related disorders.

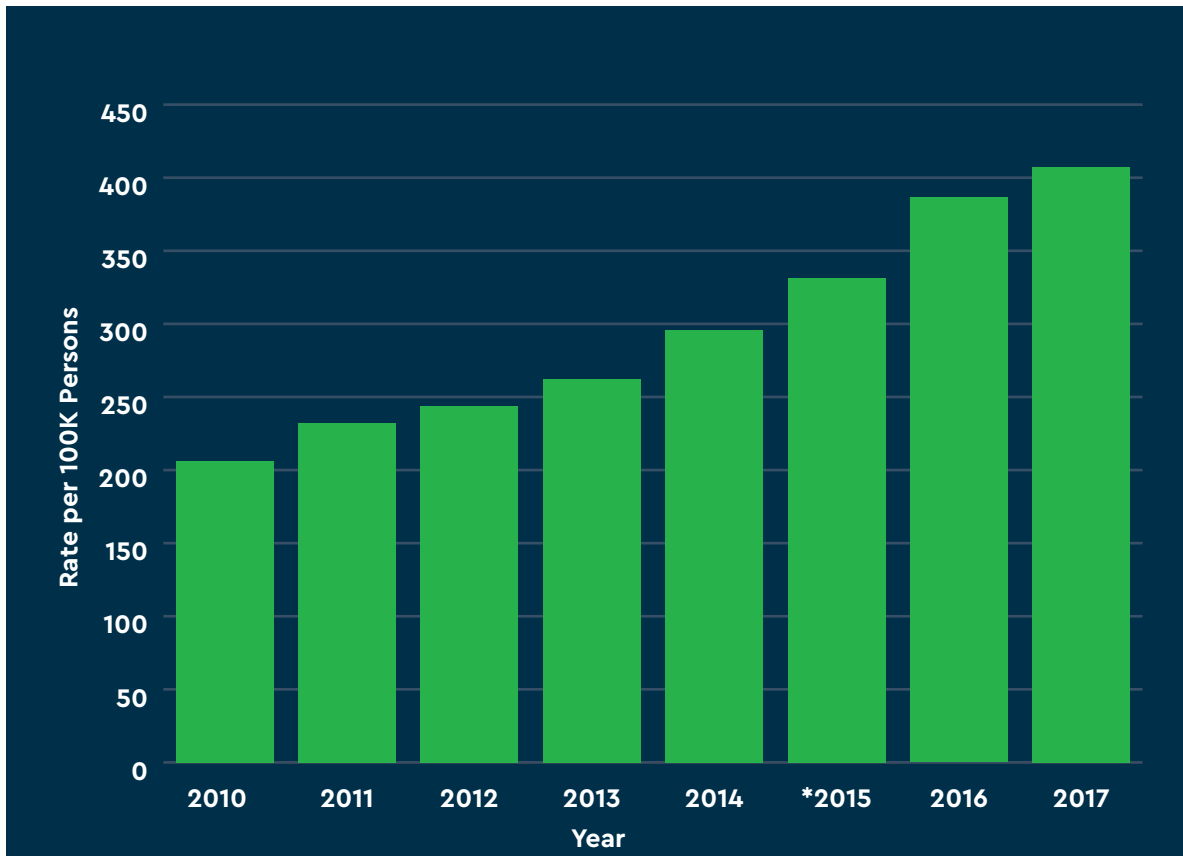


FIGURE 28:
Rates of Inpatient Hospitalizations Involving Cannabis-related Disorders as Any Listed Diagnosis

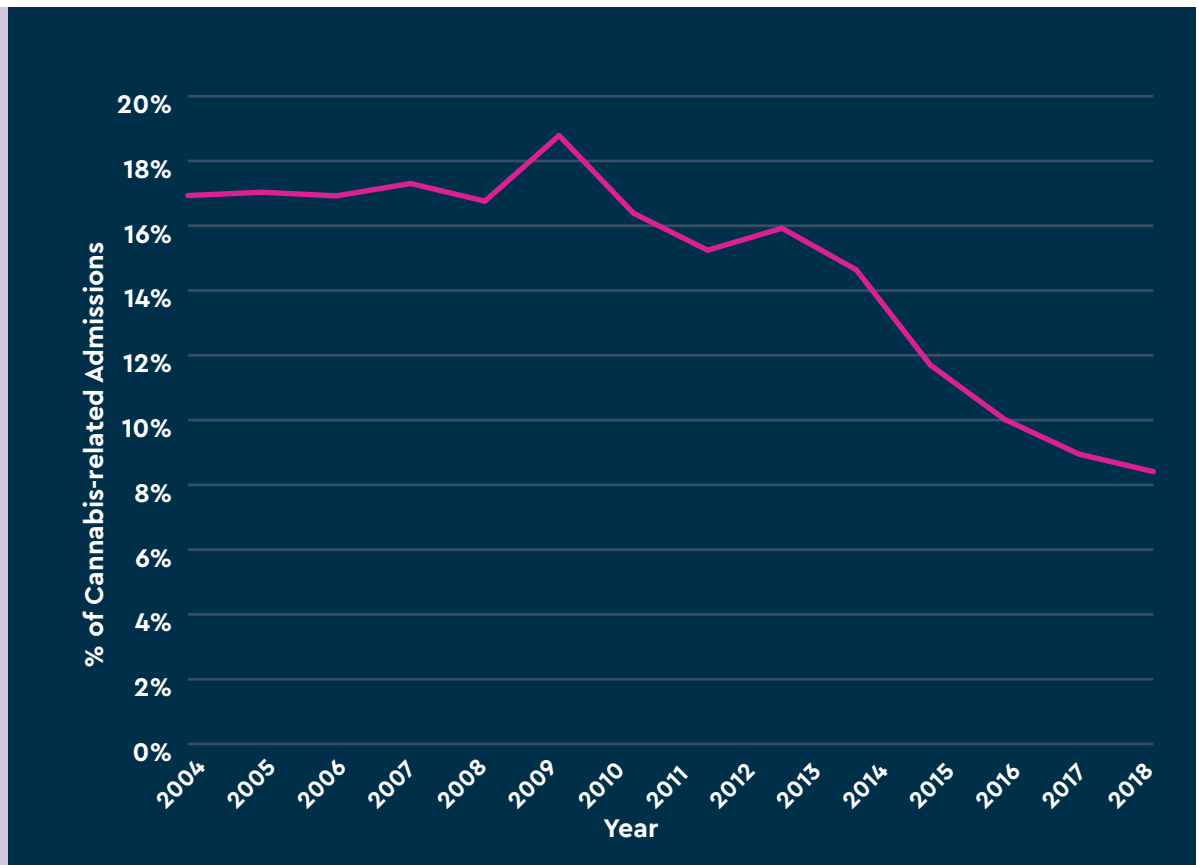
**The transition to the new ICD coding system occurred in 2015.*

Substance Use Disorder Treatment

In the U.S., few people with cannabis use disorders receive substance use disorder treatment. According to the 2017 National Survey on Drug Use and Health (NSDUH), fewer than 10% of individuals 12 years and older with a cannabis use disorder received treatment.⁷² Thus, it is important to note that data pertaining to treatment admissions in the state of Michigan does not necessarily represent the entire population with a CUD diagnosis and/or the entire population that could potentially benefit from treatment. The Michigan Treatment Episode Data Set (TEDS), provided by the Michigan Department of Health and Human Services (MDHHS) to the Michigan High Intensity Drug Trafficking Area (HIDTA) team from 2005 through 2018, provides data on substance use treatment service utilization across programs receiving state alcohol/drug agency funding, including federal block grants. These programs can provide a range of services across levels of care from admission to detoxification to outpatient or residential programs and may also include medication assisted therapies (MAT).

- While the total number of substance use treatment admissions increased by 3.7% from 2005 to 2018 (from 69,775 to 72,330), the percentage of cannabis-related admissions decreased by 48.5% during the same time period (See figure 29).
- The percentage of all substance use treatment admissions that were cannabis-related peaked in 2010 (18.8%), but has decreased overall from 16.9% in 2005 to 8.4% 2018.⁷³

FIGURE 29:
Percentage
of Substance
Use Treatment
Admissions
Related to
Cannabis, by
Year



- The population rate of cannabis-related admissions decreased overall from 2005 to 2018 with the highest being 123.2 per 100,000 in 2006 and the least being 60.8 per 100,000 in 2018⁷³ (See figure 30).

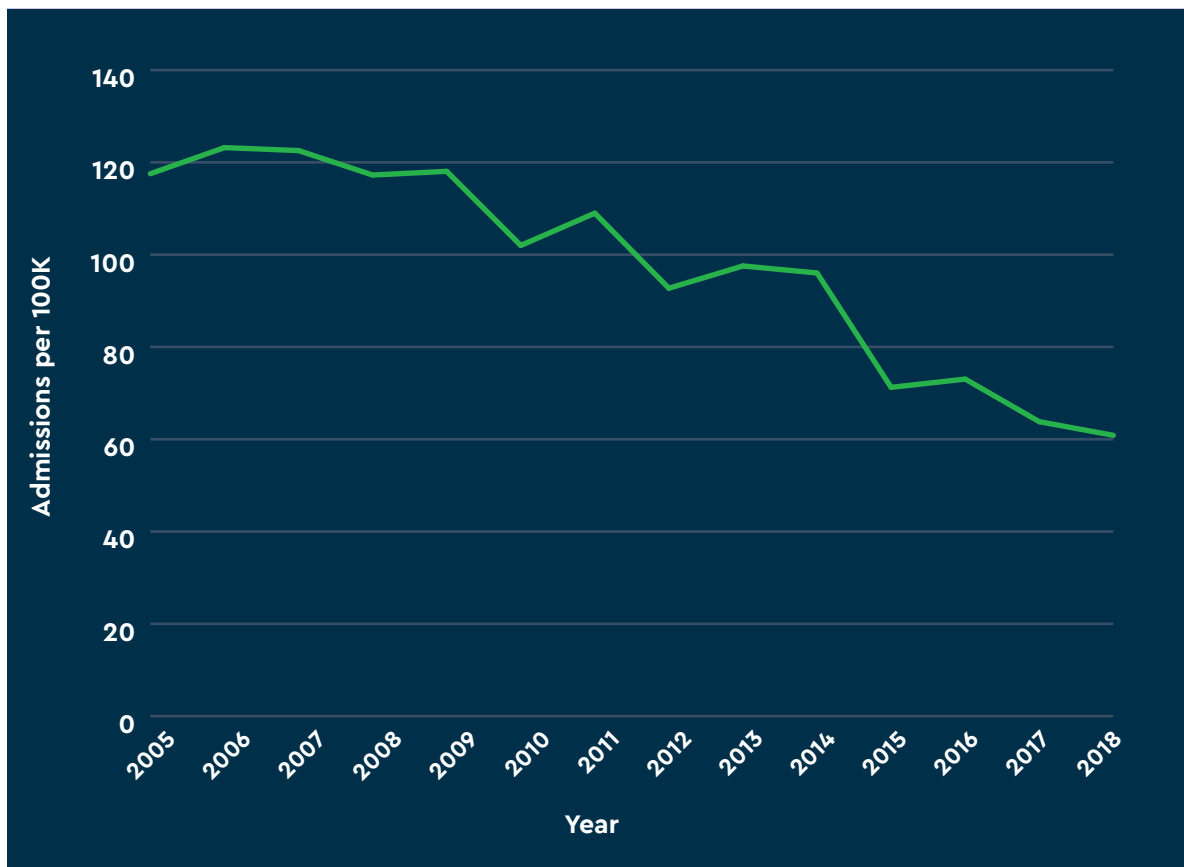



FIGURE 30:
Population Rate
of Substance
Use Treatment
Admissions
Related to
Cannabis, by
Year per 100K

Recent annual online Michigan TEDS data⁷⁴ for the years 2014 to 2018, allows for examination of substance use disorder treatment admissions within different age groups.

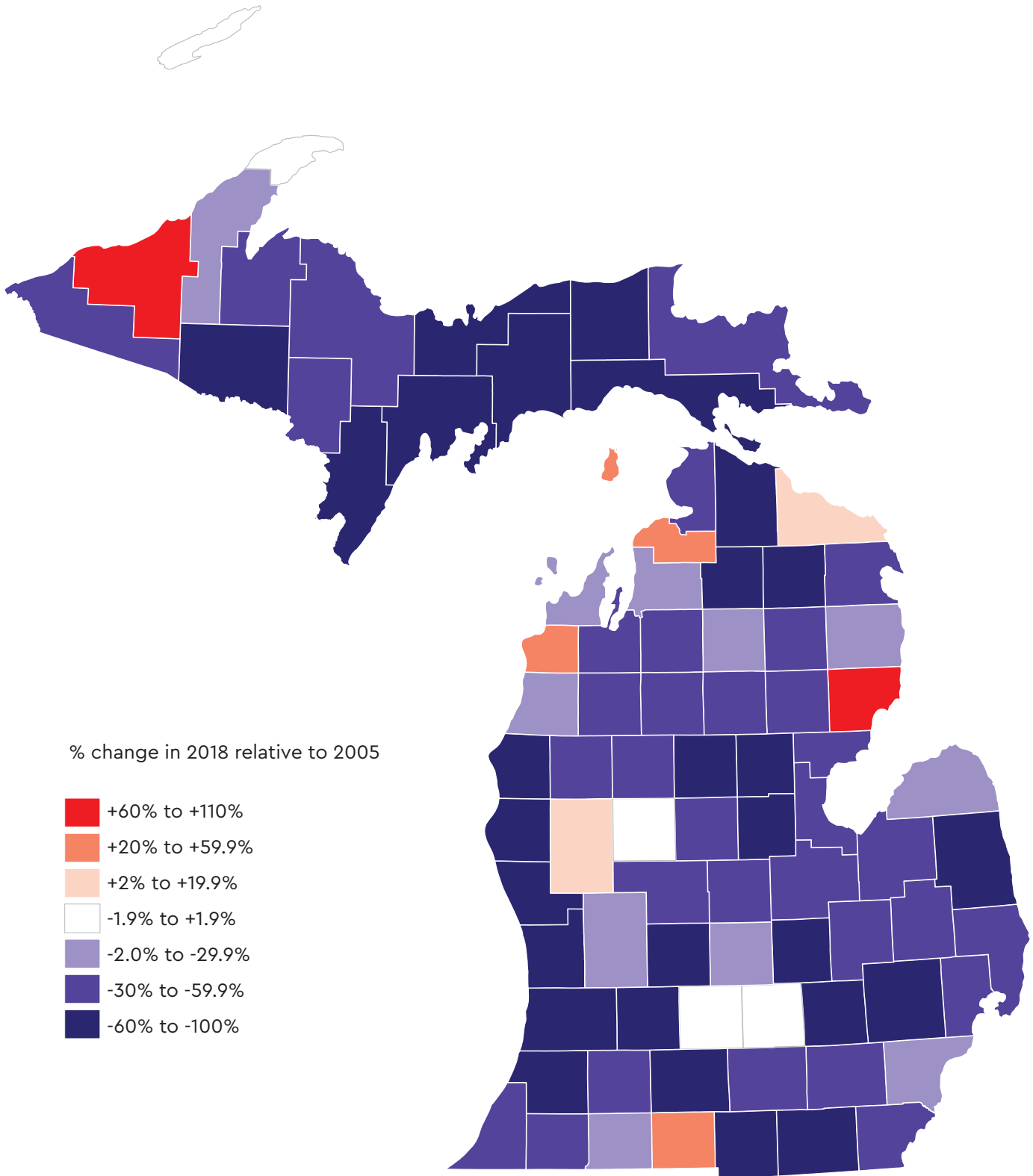
- Adolescents (ages 12–17) with cannabis as their primary substance listed at treatment admission comprised 2.7% of treatment admissions in 2014, declining to 1.2% in 2018, a 55.6% decrease.
- Young adults (ages 18–25) comprised 4.9% in 2014, declining to 2.6% in 2018, a 46.9% decrease.
- Adults (aged 26 and older) comprised more treatment admissions with 6.3% in 2014, declining to 4.2% in 2018, a 33.3% decrease.
- TEDS data from 2018 indicates that 64% of those seeking treatment related to cannabis were men and the remaining 36% were women.



The Michigan Treatment Episode Data Set provided by MDHHS to HIDTA (2005 through 2018 data),⁷³ was used to create a map depicting the percentage change in the rate of cannabis-related substance use treatment admissions (2018, relative to 2005) (See figure 31). Darker red colors indicate an increase in treatment admissions and darker purple colors indicate a decrease in admissions.

- Eleven counties (Alcona, Clinton, Eaton, Houghton, Ingham, Keweenaw, Leelanau, Mecosta, Newaygo, Presque Isle, Wayne) had relatively little change (<20% change in either direction).
- Five counties saw >20% increases in treatment admissions: Branch (26.9%), Benzie (49.5%), Charlevoix (55.9%), Iosco (110.3%), Ontonagon (90.9%).
- The largest reduction was 97.5% (Menominee county). Other major counties showing reductions were, Oakland (-62.9%), Muskegon (-71.5%), Monroe (-38.2%), and Macomb (-37.2%).
- The largest county in the state, Wayne county, which includes Detroit, showed a reduction of 7.5% in 2018 relative to 2005.

FIGURE 31:
Percentage Change in the 2018 Cannabis Treatment Admissions Rate, Relative to the 2005 Rate



CONCLUSIONS

- Because only two years of data were provided, conclusions regarding time trends in ED visits related to cannabis are limited, though initial evidence suggests that ED visit diagnoses that include adverse effects of cannabis use, cannabis poisoning, and/or cannabis-related disorders have increased. These types of ED visits will be important to monitor over time, especially given that recreational legalization that could increase access to more high potency cannabis products.
- Inpatient hospitalizations (2010–2017) involving cannabis poisonings have increased, which highlights the need for decreasing unintentional access/ingestion, as well as prevention programs addressing adolescents' and young adults' risky use, especially as higher potency cannabis-containing products (e.g., edibles) become available for recreational purchase.
- Substance use disorder treatment admissions for cannabis as the primary drug associated with admission have decreased in state programs. This could reflect reductions in treatment availability during the rise of the opioid epidemic.
- Epidemiological data (see pages 26–29) indicates that cannabis use disorders are declining statewide. Consistent with these findings, state substance use disorder treatment admissions for cannabis as the primary drug associated with admission have decreased. Nonetheless, treatment services are drastically underutilized by those with cannabis use disorders,⁷⁵ with only a small minority of affected individuals receiving treatment. Thus, increased access to healthcare services for those with cannabis use disorder remains a priority.⁷²
- While changes in admissions for cannabis use disorders in certain counties could relate to changes in funding priorities or availability of treatment beds and/or changes in the rates of other substance use disorders (e.g., opioid use disorders), data were not available to address this question. Additional data should be collected in future studies to clarify these findings.

CRIMINAL JUSTICE AND LEGAL SYSTEM DATA

INTRODUCTION

The ways in which cannabis use, cultivation, and sales intersect with the legal and criminal justice systems are complex, given the changing policies and tension between state and federal laws. The sections below review information pertaining to cannabis-related legal charges and convictions, law enforcement seizures of illegally produced cannabis products, as well as information on trafficking of cannabis and parcel seizures.

FINDINGS

Cannabis-related Charges and Convictions

Before the enactment of the Michigan Regulation and Taxation of Marihuana Act (MRTMA) on December 6, 2018, possession and use of cannabis for recreational purposes was illegal at the state-level (i.e., only individuals with medical certification from the State of Michigan could possess and use cannabis), and it remains illegal for those under the age of 21. Thus, criminal justice information, such as trends in cannabis-related convictions, provide important state-level information about the context of cannabis as it relates to the criminal justice system in Michigan. It will be critical to continue to monitor these data in future years, especially as it relates to the impact of MRTMA on important cannabis-related criminal justice outcomes. Data from the Michigan State Court Administrative Office's Judicial Data Warehouse (JDW) provides critical cannabis-related criminal justice information from individuals charged in the adult courts system. Cannabis-related charges include any offense related to the possession, use, manufacturing, delivery, or distribution of cannabis products. Examples include possession of cannabis and delivery/manufacture of cannabis.

- The number of cannabis-related charges filed in Michigan increased overall during the timeframe from 2012 (18,956) to 2018 (19,406) with the number of charges peaking in 2016 (22,992) (See figure 32).

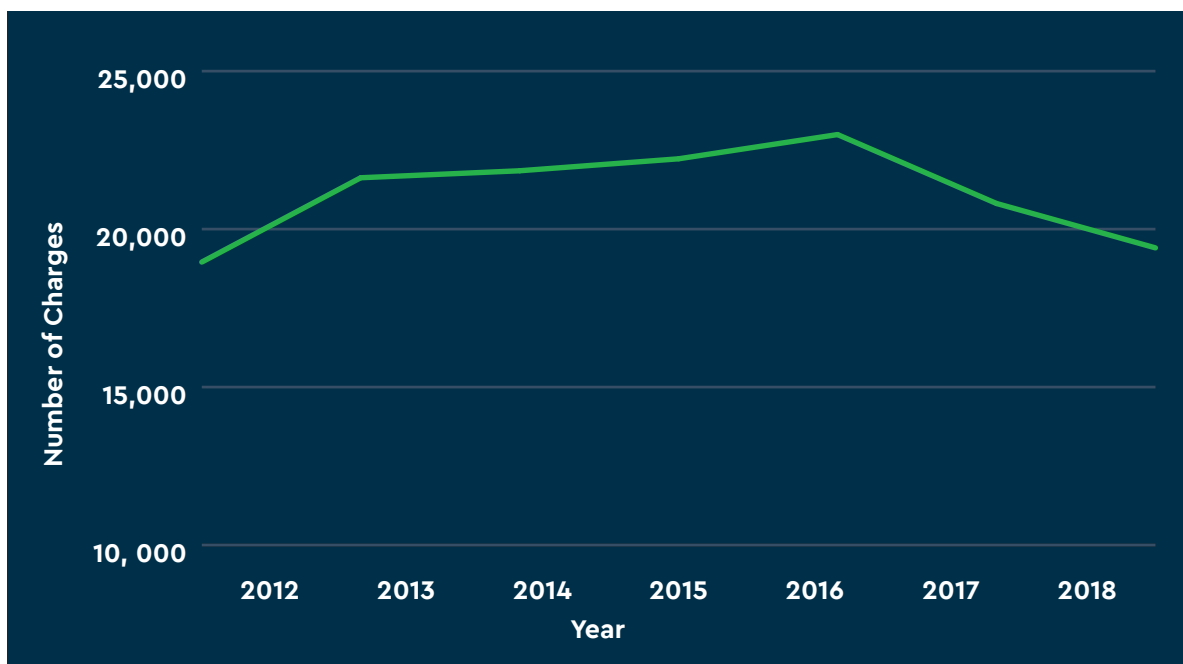
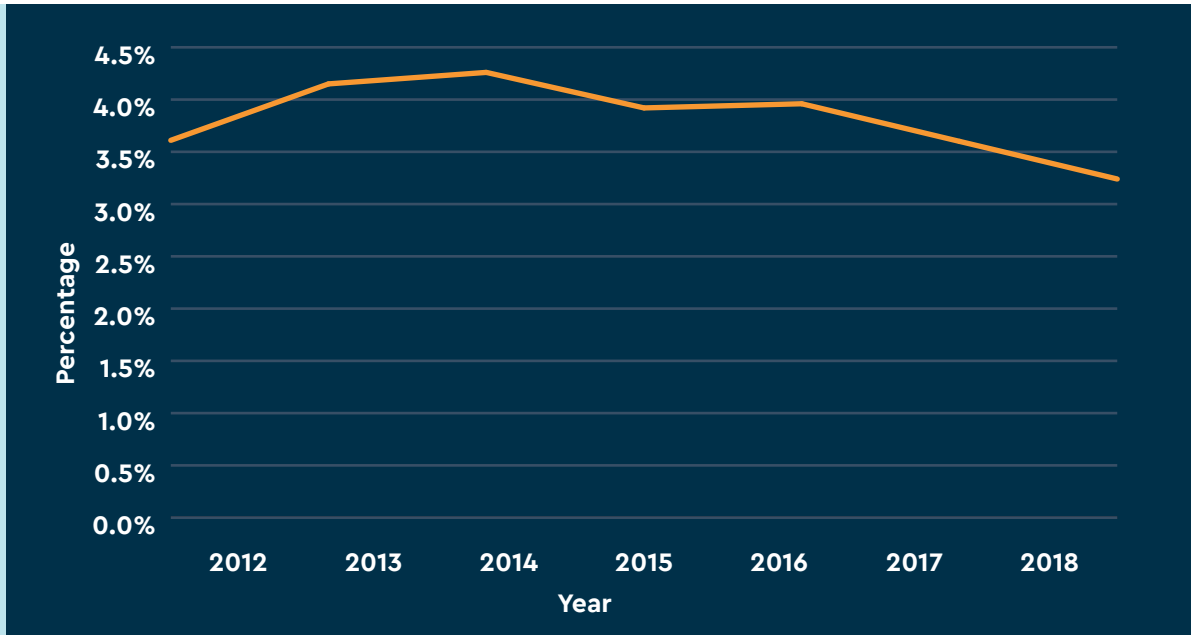


FIGURE 32:
Cannabis-related
Charges in
Michigan

- Of the nearly 2.5 million misdemeanor and felony convictions (from 2012 to 2018) in Michigan, 3.8% (95,838) were cannabis-related convictions with 2.0% (50,772) including a cannabis-related conviction with a concurrent felony conviction (See figure 33).
- From 2012 to 2018, 53% of cannabis-related convictions involved a concurrent felony conviction.
- The percentage of cannabis-related convictions among all convictions was highest in 2014 (4.2%) and lowest in 2018 (3.2%).

FIGURE 33:
Cannabis-related Convictions as a Percentage of All Misdemeanor and Felony Convictions in Michigan





Cannabis Seizures by Michigan HIDTA Task Force Teams

Drug seizure data provide important contextual information regarding cannabis cultivation and law enforcement seizures. Michigan has large areas of uncultivated land, and cannabis is grown across the state. Grow operations in the state have been found in the Upper and Lower Peninsulas on state and federal land, as well as farmland and other land owned by private individuals and companies.⁷⁶ Data presented below comes only from seizures made and reported by Task Force Teams sponsored by the Michigan High Intensity Drug Trafficking Areas (HIDTA), and provide important information, including trends, regarding cannabis seizures in Michigan.⁷⁷

To provide some background,^{78,79} HIDTA programs were created by Congress as part of the Anti-Drug Abuse Act of 1988 and are administered by the Office of National Drug Control Policy. HIDTA initiatives occur in localities identified as critical drug-trafficking corridors. The Michigan corridor comprises 12 counties and about 6.3 million people (about 63% of the state population), has an international border (Canada), and is critically located along major interstate routes between the Chicago and New York City drug markets. HIDTA programs seek to identify and remove drug trafficking and money laundering organizations (DTOs and MLOs) and in 2018 involved 126 partnering federal, local, and state agencies. The local Michigan HIDTA encompasses seven major drug markets: Detroit, Flint, Grand Rapids, Kalamazoo, Muskegon, Port Huron, and Saginaw. Note that the data provided below regarding HIDTA seizure activities does not include seizures made by every law enforcement agency in the state.

- Based on information from the Michigan HIDTA Threat Assessment, the majority of cannabis grow operations in Michigan are indoor grow operations on private property.⁷⁸
- Overall, the trend for indoor grown cannabis plant seizures by Michigan HIDTA teams fluctuated from 2010 to 2018.

- The Michigan HIDTA teams seized 4,886 kilograms (worth \$24.4 million) of indoor grown cannabis plants in 2010. The seizures dropped in 2014 (3,398 kilograms worth \$17.2 million) but increased again in 2015 (7,226 kilograms worth \$36.6 million) and then declined steadily to 4,173 kilograms (worth \$20.5 million) in 2018 (See figure 34 and figure 35).

FIGURE 34:
Total Weight (Kg) of Indoor Cannabis Plant Seizures by Michigan HIDTA Teams, by Year

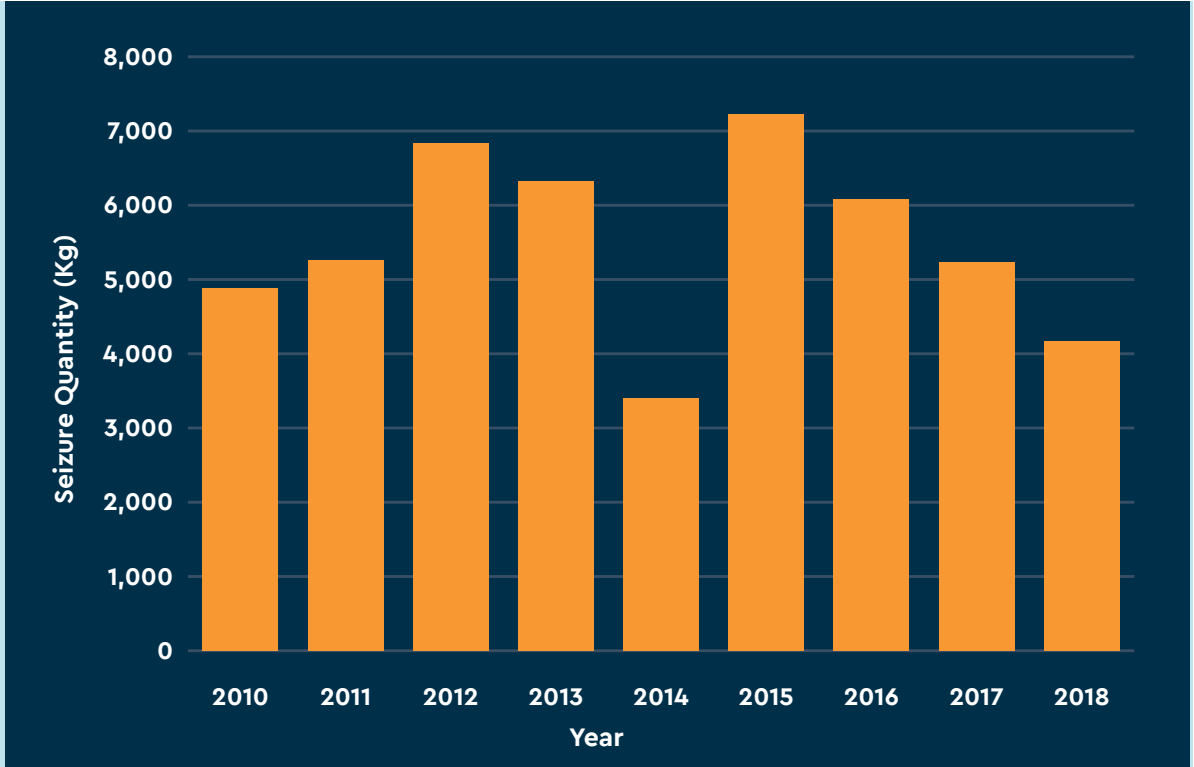


FIGURE 35:
Total Dollar Value of Indoor Cannabis Plant Seizures by Michigan HIDTA Teams, by Year



- Trends for outdoor grown cannabis plant seizures decreased from 21,418 kilograms (worth \$74.9 million) in 2010 to 686 kilograms (worth \$3.3 million) in 2018 in part due to the demand for indoor grown cannabis with a higher THC potency (See figure 36 and figure 37).

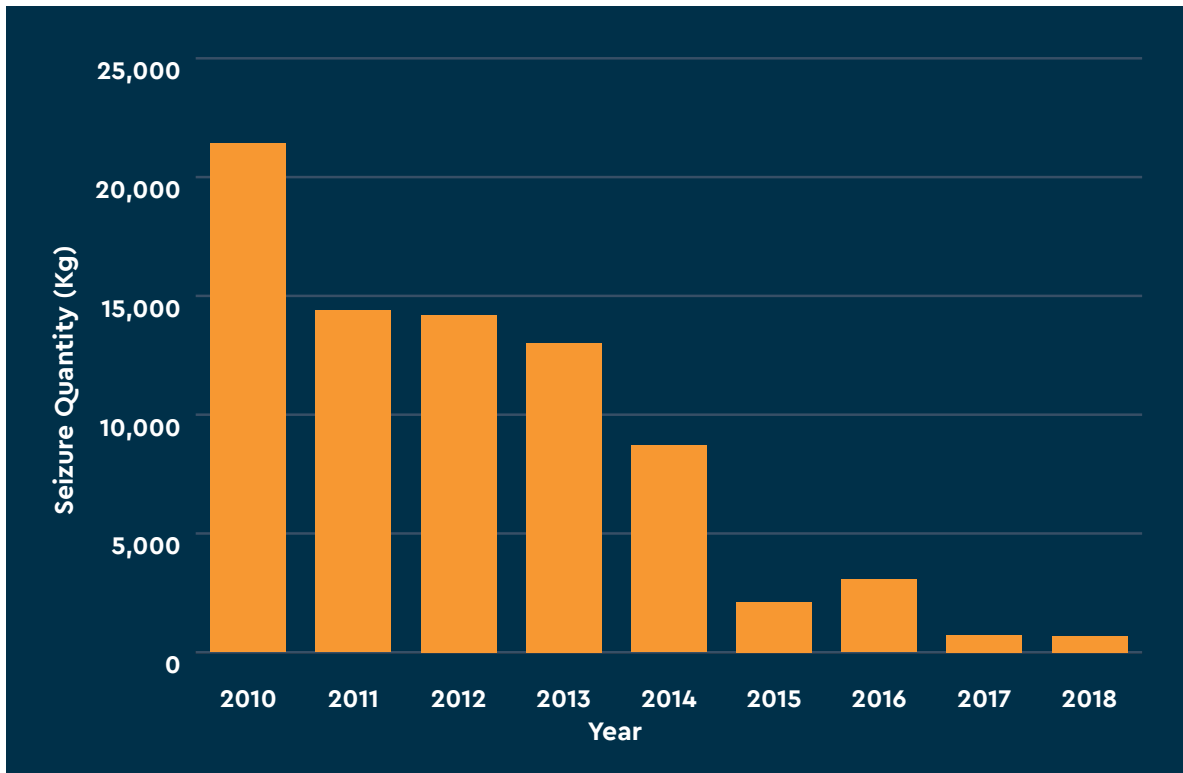


FIGURE 36:
Total Weight (Kg) of Outdoor Cannabis Plant Seizures by Michigan HIDTA Teams, by Year

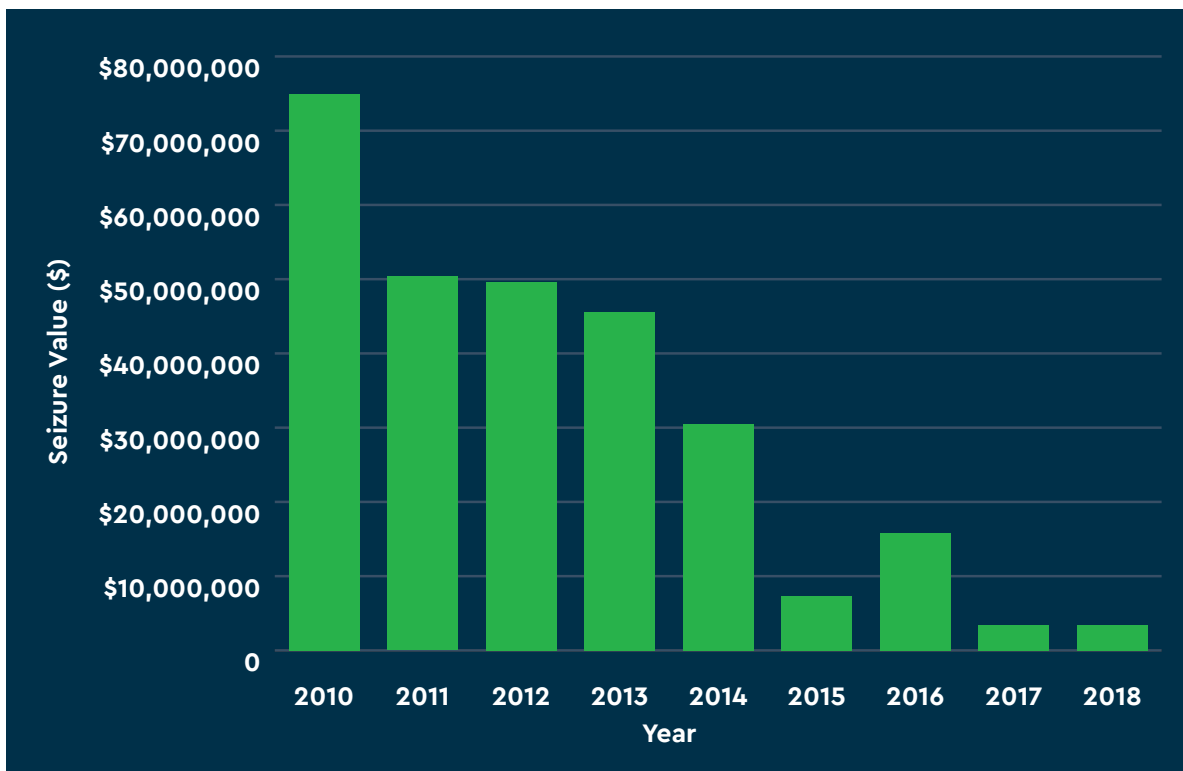


FIGURE 37:
Total Dollar Value of Outdoor Cannabis Plant Seizures by Michigan HIDTA Teams, by Year

- In addition to the data presented on the previous page, information from the Michigan State Police's Domestic Cannabis Eradication and Suppression Program (DCE/SP) indicates that the total number of plants seized, indoor and outdoor, decreased from 18,804 in 2017 to 12,871 in 2018, a decrease of 31%.⁷⁶
- The total weight of illegal or illicit edible cannabis product seizures by Michigan HIDTA teams increased overall from 2.48 kilograms (worth \$5,456) in 2013 to 1,082 kilograms (worth \$5.1 million) in 2018 (See figure 38 and figure 39).

FIGURE 38:
Total Weight (Kg) of Edible Cannabis Products Seizures by Michigan HIDTA Teams, by Year

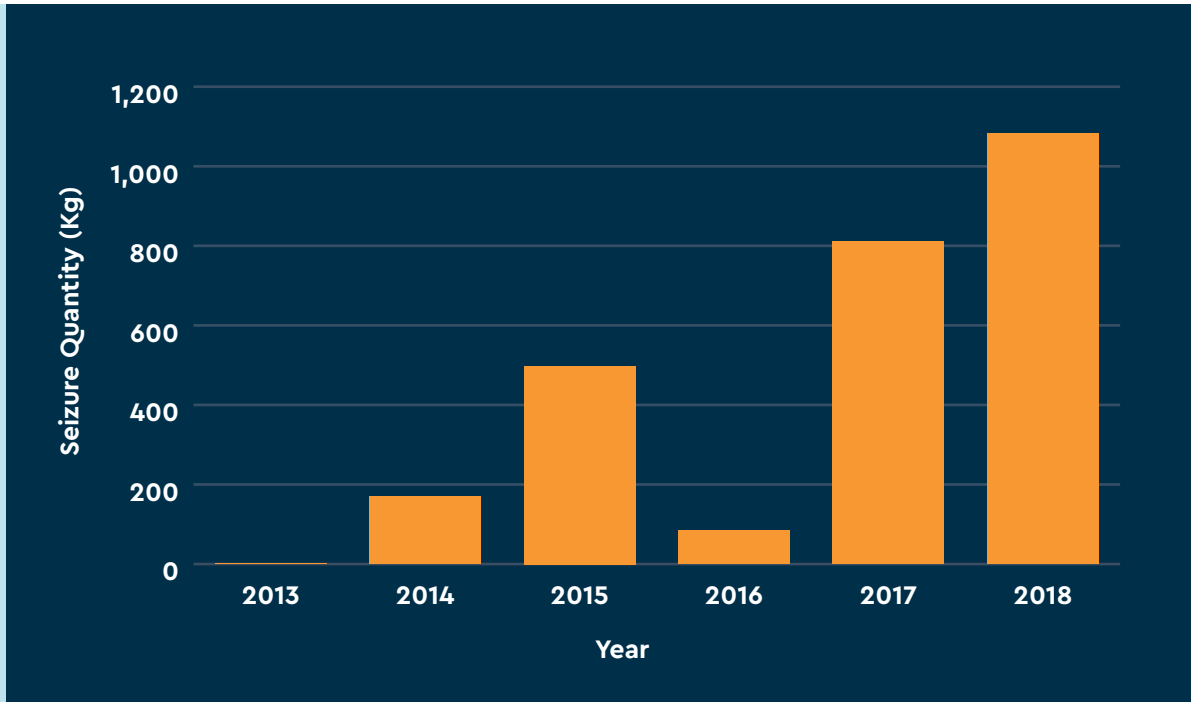
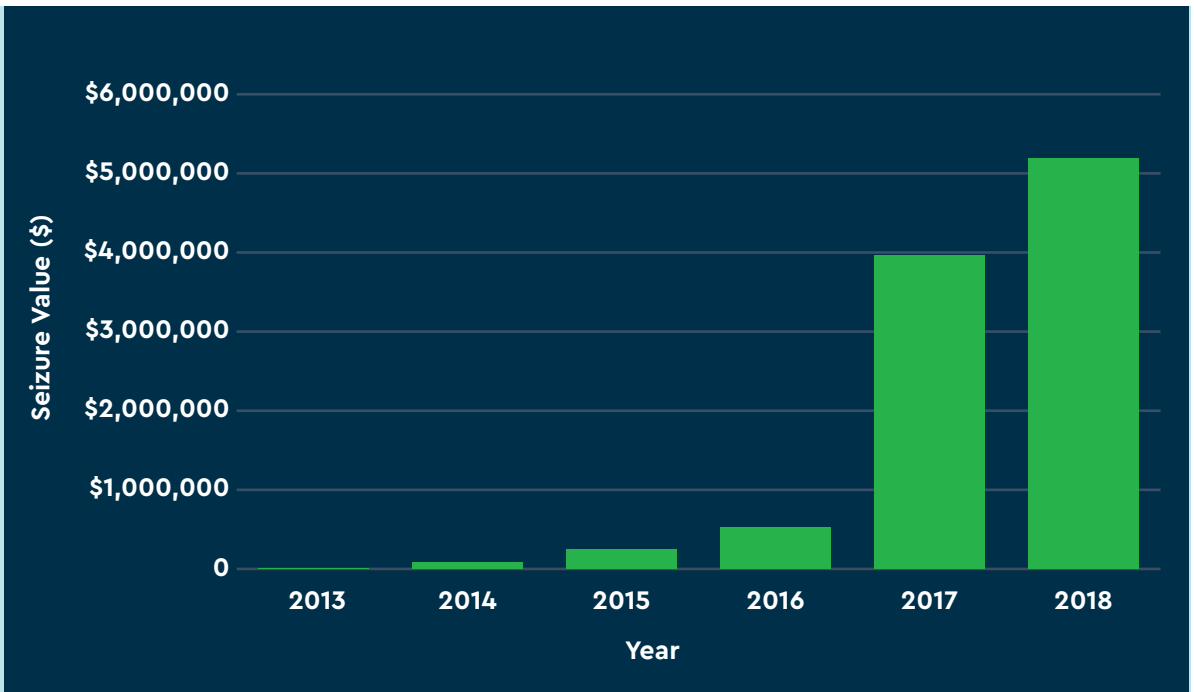


FIGURE 39:
Total Dollar Value of Edible Cannabis Products Seizures by Michigan HIDTA Teams, by Year



- From 2010 to 2018, the seizure of bulk processed cannabis was highest in 2010 (10,772 kilograms worth \$23.6 million). The seizures dropped by about 40% in 2011 (6,179 kilograms worth \$13.5 million) (See figure 40 and figure 41).
- The weight of seizures declined steadily through 2013 (3,086 kilograms) then gradually began to rise beginning in 2016. However, the total wholesale value of bulk processed cannabis seized increased from \$23.6 million in 2010 to \$32.1 million in 2018 (See figure 40 and figure 41).

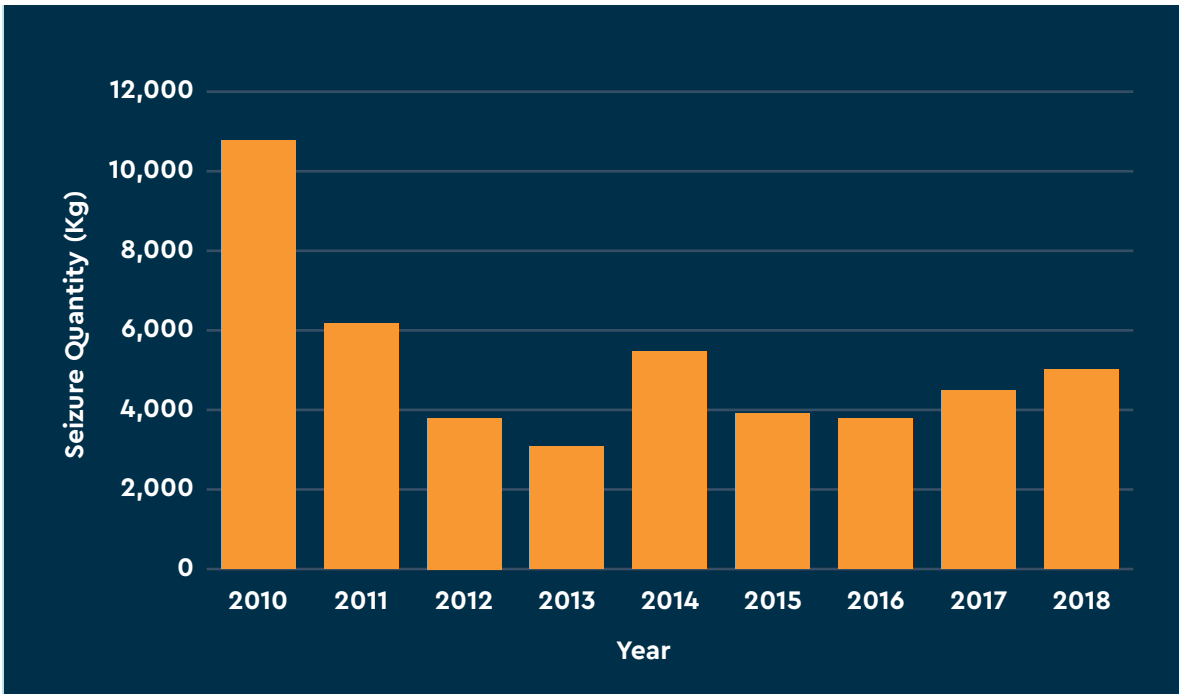


FIGURE 40:
Total Weight (Kg) of Bulk Processed Cannabis Seizures by Michigan HIDTA Teams, by Year

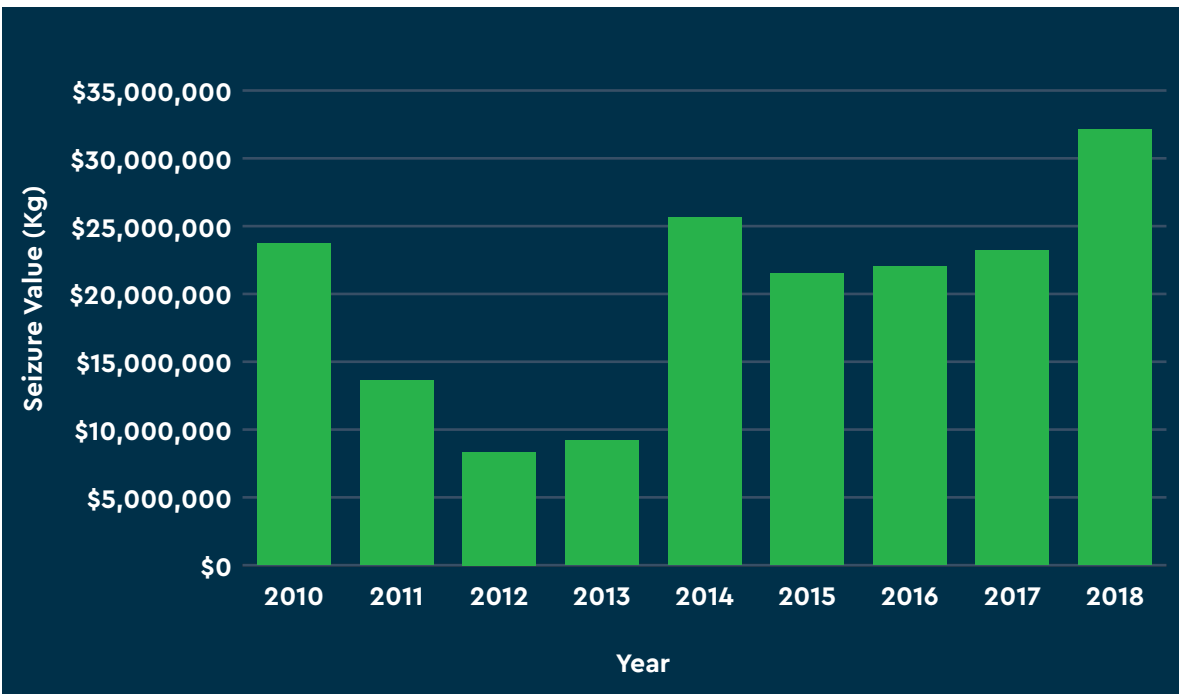


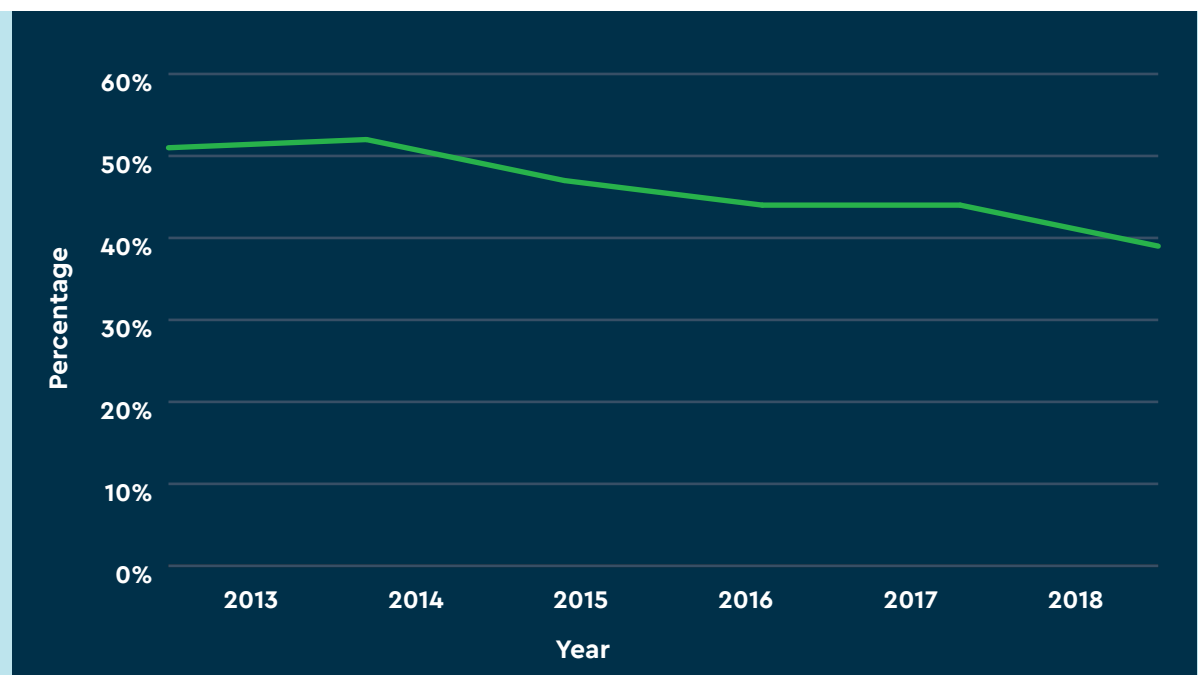
FIGURE 41:
Total Dollar Value of Bulk Processed Cannabis Seizures by Michigan HIDTA Teams, by Year

Trafficking, Highway Seizures, and Postal/Parcel Seizures

Drug interdiction data provide important information regarding the cannabis supply in Michigan. Parcel delivery services, including FedEx, United Parcel Service (UPS), and the United States Postal Service (USPS), are common methods for trafficking cannabis and other drugs.⁷⁸

- Cannabis is trafficked into Michigan from other states through the U.S. mail, express consignment, as well as via plane, truck, and motor vehicle.
- Based on data from the United States Postal Inspection Services (USPIS) for FY 2018, the top three destinations for shipped packages containing drugs were: Detroit, Grand Rapids, and Kalamazoo.⁸⁰
- Based on available information from law enforcement, drug trafficking organizations (DTOs) use major interstate corridors in Michigan, especially I-75 and I-94, to transport cannabis.⁷⁸
- There was a reduction from 2013 to 2018 in the number and percentage (of all DTOs under investigation by HIDTA Task Force Teams) of DTOs under investigation that trafficked cannabis. Namely, the number (and percentage) fell from 151 DTOs (or 52% of all DTOs under investigation) trafficking cannabis in 2013 to 88 DTOs (or 39% of all DTOs under investigation) trafficking cannabis in 2018⁸¹ (See figure 42).

FIGURE 42:
Percentage
of DTOs/
MLOs Under
Investigation
that were
Trafficking
Cannabis



CONCLUSIONS

- Cannabis-related criminal justice data show decreases in the percentage of cannabis-related convictions among all convictions, which requires future monitoring given changes in the legal status of cannabis.
- Trends in seizures vary based on the type of cannabis, with outdoor plant seizures decreasing the most and edible cannabis product seizures increasing. Indoor plant seizures have fluctuated from 2010 to 2018, thus it is difficult to discern a stable trend in one direction. As seizure data come from HIDTA Task Force Teams, changes in trends may reflect changes in team priorities (e.g., focus on illicit opioids, methamphetamine, and cocaine). Based on threat assessments produced annually, Michigan HIDTA enforcement teams have focused their investigative efforts and resources on prescription drug diversion, heroin and opioid drug trafficking organizations for the past several years due to the seriousness of the threat posed by these organizations.
- While the total weight of bulk processed cannabis seized has declined over time, the total wholesale value of these seizures is increasing, likely due to shifts toward higher quality cannabis grown indoors throughout the state.

ECONOMIC INDICATORS

INTRODUCTION

Cannabis is the most widely available drug (excluding alcohol or tobacco) in Michigan, as evidenced by the aforementioned seizure data (see pages 69–74) as well as drug team survey responses showing that 100% of local and state drug teams reported cannabis is readily available throughout the state.^{82,83} Locally grown cannabis is in high demand and law enforcement in southeast Michigan reports an expanding number of cannabis grow operations.⁸⁴ High availability and demand is likely based on several factors, including the relative popularity of Michigan's Medical Marihuana Act in 2008 and the decriminalization of cannabis in several cities and jurisdictions that followed. Moreover, with the November 2018 passage of the MRTMA, which legalized recreational cannabis for adults aged 21 years and older in Michigan, availability, demand for cannabis in Michigan, and distribution to other states are likely to increase.

FINDINGS

- Based on law enforcement data, cannabis is generally acquired at private residences, through street sales, or from medical cannabis dispensaries.⁸²
- According to recent information from the Drug Enforcement Administration (DEA), the street value of domestic cannabis in the Detroit area ranges from \$1,800 to \$4,000 per pound, whereas, cannabis from Mexico is least expensive at \$450 to \$1,200 per pound.⁸⁴
- The price of other cannabis products varies, with a recent local media report noting the average cost of butane hash oil ranges \$70–\$100 per gram.⁸⁵

CONCLUSIONS

- Locally grown cannabis is more highly valued than cannabis grown in Mexico, indicative of the higher quality cannabis being grown locally.
- Price estimates for cannabis products such as butane hash oil are currently limited.
- How the price of cannabis will change, as well as where people will acquire cannabis from as it becomes available on the retail market, remains to be seen.

FUTURE DIRECTIONS

Although the data summarized in this report reflect a variety of areas potentially impacted by cannabis use, there are a number of other areas where we were unable to identify a data source or were outside the scope of the current report. In addition to addressing the limitations of current data, to the extent data becomes available in the future, we suggest several areas for potential inclusion in future reports and for tracking cannabis-related trends over time. Additional information pertaining to these areas may provide a more comprehensive view of the short- and long-term impact of cannabis legalization in Michigan. These areas include:

- 1.** Further data pertaining to cannabis-related fatal and non-fatal MVC (e.g., increased and uniform blood testing for cannabis among drivers in crashes).
- 2.** Vaping cannabis and related morbidity and mortality, given emerging trends in vaping-related lung problems.^{86,87}
- 3.** Workplace injuries and the extent to which individuals lose jobs or are not hired due to cannabis use.
- 4.** Residential and industrial fires due to cannabis use and production.
- 5.** Cannabis-related calls to Poison Control Centers.
- 6.** Data from the 2-1-1 call center to report on the number of people who call to seek help for cannabis use disorders.
- 7.** Cannabis-related school suspensions and expulsions among youth.
- 8.** Truancy and unemployment among youth.
- 9.** Cannabis-related reports to and investigations by Children's Protective Services (CPS).
- 10.** Trends associated with use of other substances (e.g., alcohol, other drugs).
- 11.** Potency data for cannabis plants and products seized and those on the retail market.
- 12.** Environmental considerations, such as the cannabis industry's impact on energy and water consumption.
- 13.** Population exposure, particularly youth, to cannabis-related advertising.
- 14.** Impact of cannabis exposure on personal pets and K-9 unit dogs.
- 15.** Cost evaluation (cost for management/oversight, cost of education, cost of effects on health).

LIMITATIONS OF THE DATA USED IN THIS REPORT

We have highlighted limitations of the datasets from each section in order of appearance within the text of the report. We encourage readers to view the full report in order to understand the findings in light of these limitations of the available data.

LONG-TERM TRENDS IN CANNABIS USE, LONG-TERM TRENDS IN CANNABIS USE DISORDER, AND BELIEFS ABOUT CANNABIS USE

Limitations of the National Survey on Drug Use and Health (NSDUH)

Limitations of NSDUH include standard concerns regarding retrospective, self-reported data, such as that it is subject to recall bias and demand characteristics; thus, under- and/or over-reporting are both possible.⁸⁸ Similarly, as these data are cross-sectional, causal interpretations are discouraged and inferences should be limited to the examination of population trends, rather than individual changes over time. Generalizability of these data are limited to civilian, non-institutionalized individuals; active-duty military and institutionalized persons (e.g., hospitals, prisons, inpatient/residential treatment, nursing homes) are excluded. Thus, individuals who are at higher risk for drug use may be excluded due to homelessness, incarceration, and/or treatment. In addition, note that data pertaining to cannabis use disorder (CUD) does not represent a diagnosis made by a medical professional and that assessment of cannabis use does not provide fine-grained detail regarding different consumption methods used (e.g., vaping, dabbing, tinctures, etc.), and/or quantity or potency of cannabis.

CANNABIS USE AND PREGNANCY

Limitations of Michigan Pregnancy Risk Assessment Monitoring System (MI PRAMS)

The MI PRAMS assessment of cannabis use only measures any use, and is therefore unable to provide greater granularity regarding frequency or quantity of cannabis use as well as the type of method used. Additionally, MI PRAMS did not assess the strain and/or potency of the cannabis used. Note also that survey responses could be obtained between 11 weeks and 9 months post-partum, meaning that there was variation in the time period over which participants had to recall their pre-pregnancy cannabis use as well as the time period assessing post-birth cannabis use. Other potential limitations include the self-reported nature of the survey and modest response rates.

CANNABIS USE IN THE MICHIGAN WORKFORCE

Limitations of the Quest Diagnostics Drug Testing Index

There are two major limitations of these publicly available data. First, these data only represent companies that use the Quest service¹⁸ and do not fully generalize to the entire Michigan workforce, as they do not represent companies or private employers that do not utilize Quest for drug testing, and drug testing is not a uniform practice across Michigan employers. Second, individual data are not publicly available and therefore trends in cannabis positive tests in this sample cannot be further examined.

MEDICAL CANNABIS

Limitations of Medical Marijuana Statistical Reports

While the data provided from these reports help quantify several aspects of the state's medical cannabis program, there are some limitations to note. First, note that although medical cannabis was approved in 2008, data from fiscal year 2009 are excluded from our report because they come from an incomplete fiscal year. Further, we found that the 2010 statistic report data were not available per our communication with the Michigan Department of Licensing and Regulatory Affairs (LARA). Thus, much of our data is limited to fiscal year 2011 and after and does not represent the entire history of the medical cannabis program in this state. Note also that while minors can obtain a medical cannabis certification under certain regulations, data pertaining to minors were only reported in the 2011 and 2012 reports. Further, note that changes in the allowed qualifying conditions over the life of the medical cannabis program in Michigan complicates tracking trends in medical conditions over time. Finally, information regarding numbers of patients, caregivers, and licenses processed each year are impacted by the speed at which applications are approved, which could account for some fluctuation in total numbers (e.g., new licenses, renewals) from year to year when delays in approvals occur.

CANNABIS AND THE OPIOID EPIDEMIC

Limitations of the Michigan Automated Prescription System (MAPS)

One limitation of the MAPS system is that it does not include all opioids dispensed as there are a few reporting exemptions (e.g., substances administered to patients, samples provided to patients, substances administered at a medical facility for fewer than 48 hours).⁸⁹ Further, MAPS does not account for prescriptions written or filled out of state. In 2018, legal changes in the state of Michigan also increased regulations regarding who must use the MAPS system, requiring physicians prescribing or dispensing a controlled substance to register with MAPS, and those releasing more than a 3-day supply to obtain and review a MAPS report for the patient. Prescribing limits for acute pain (limiting to a 7-day supply) were also enacted. Thus our data obtained through 2016 do not reflect opioid prescriptions within the current policy context.

Limitations of Michigan Death Certificate Data

Death certificate data can be limited in that not all deaths involve toxicology testing with results recorded to the death certificate. When toxicology testing is completed, specific drugs may not be indicated due to a number of reasons such as inconclusive testing. Medical examiner practices and the information reported on death certificates (accuracy and completeness) also have individual variation. Further, information pertaining to opioid-related deaths presented here only show time trends in number of deaths. When considering the relationship between cannabis use and opioid-related deaths, these data cannot be used to quantify prevention of opioid-related deaths, which is a key question. That is, we cannot use these data to show whether individuals who were at risk for opioid overdose switched from opioids to cannabis for pain management and potentially avoided overdose. This remains a question for future investigation.

MOTOR VEHICLE CRASHES AND IMPAIRED DRIVING

Limitations of the data from the Michigan Traffic Crash Facts (MTCF) website

The MTCF website provides annual Michigan police-reported crash data. One limitation of the data is that police-reported crash data are collected for administrative reasons and accuracy is encouraged, but there is variation in how individual police officers collect and report these data. The second major limitation is that not everyone is tested for drugs; especially, if the driver has sufficiently high Blood Alcohol Concentration (BAC) levels (unless the driver dies).

Limitations of the Fatality Analysis Reporting System (FARS)

There are a number of caveats and limitations to consider when making sense of the FARS data.⁹⁰ It is important to note, when trying to understand impaired driving that a positive drug test, which indicates the presence of a drug in one's body, does not necessarily indicate that an individual was impaired while they were driving. The data obtained from FARS can elucidate whether a person had a drug in their system at the time of testing, but cannot prove that an individual was impaired at the time of the motor vehicle crash (MVC). In particular, cannabis can be detected via a test, weeks after use. Other limitations pertaining to FARS data include that policies and testing procedures can vary within a state and over time. For example, FARS⁹⁰ suggests that some localities test all drivers in fatal crashes and some test only those drivers who were fatally injured. There is also no standard for choosing the substances tested; there is some indication from FARS that when an alcohol test is positive for a driver, there may not be further testing for drugs. The type of test used and how well it detects the presence of a drug can also vary, as well as whether a confirmatory test is administered. Further, there is a potential that some labs do not report drug test results to FARS specifically, and there are variations in how drug test data is recorded by FARS. For example, in some cases when there are more than three drugs detected in a testing scenario, only three drugs are entered, potentially resulting in excluding some cannabis-related results.

FARS suggests that drug testing costs have decreased over time and this may have contributed to the increase in testing and the number of drugs that were examined in tests.⁹⁰ Given that drug tests are not completed for the majority of drivers in all fatal crashes the extent to which cannabis is present among drivers is not clear. Further, FARS notes⁹⁰ that testing occurs more frequently among drivers who died in the MVC compared to surviving drivers. In light of these important points, and limitations discussed in more depth below, it is important to note that we cannot conclude whether driving under the influence of cannabis is truly increasing over time. In future years, we may be able to examine state-specific self-reported impaired driving from the National Survey on Drug Use and Health (NSDUH) which could shed light on this trend, but these data are only publically reported by NSDUH for the U.S. at large for the years 2016 and 2017.

Limitations of the Medical Cannabis and Impaired Driving Data

As part of a larger grant funded by the National Institute on Drug Abuse (Grant # 033397), this study involved recruitment of patients aged 21 and older who were seeking medical cannabis certification (or renewal of an existing certification) at 3 medical cannabis certification centers in Michigan.⁵⁶ Potential participants in the study were excluded if they were pregnant or seeking certification/re-certification for a qualifying condition of Alzheimer's Disease or cancer. Participants enrolled were eligible if they reported a pain level of greater than 5 out of 10 for the past month. Patients completed a number of self-report surveys that were administered as part of the study. This study may not generalize to all medical cannabis patients in the state (given that patients were recruited from 3 locations only), but is a useful snapshot to help begin to understand driving behaviors among medical cannabis patients. Further, the data obtained from patients is cross-sectional and causality cannot be established. Similarly, as data were self-reported there is a potential for recall bias as well as under- or over-reporting.

CANNABIS-RELATED MORTALITY

Limitations of the Michigan Resident Death File (2004–2017)

The Michigan Resident Death File contains death certificate data on all deaths of Michigan residents. Each death is classified by the underlying cause of death and up to 17 related causes of death as determined by the attending physician or medical examiner. These mortality data should be considered in light of limitations. First, we excluded data on deaths of Michigan residents that occurred outside the state. Next, for a death to be classified as occurring due to cannabis poisoning, toxicology testing must be performed and recorded on the death certificate. Roughly 26% of all drug overdose deaths from 2004 to 2017 did not have a specific drug or class of drug indicated on the death certificate; this can occur for a number of reasons (e.g., inadequate sample for testing, inconclusive testing, lack of an appropriate International Classification of Diseases (ICD) code for the substance identified). However, the proportion of overdoses with a specified drug listed on the death certificate has increased over the time period; in 2017, 89% of overdose deaths had a specific drug indicated. It is also important to note that medical examiner practices and information included in a death certificate vary across individuals.

SUICIDES AND HOMICIDES

Limitations of the Michigan Violent Death Reporting System (MiVDRS)

There are some limitations of the MiVDRS system, including that medical examiner files are not available for all decedents (i.e., medical examiner files are available for approximately 89% of all victims). In addition, to limit costs, some medical examiners do not run toxicology tests when the death is judged to be an "obvious suicide" unrelated to substance use (and sometimes the medical examiner only tests for the presence or absence of alcohol). Data abstractors may also fail to indicate whether a test was run or not, leaving the field blank instead; there were 30 suicide cases and 12 homicide cases where tested/not tested information was missing in these 2016 data. Note also that Michigan Department of Health and Human Services Public Health Administration policy requires counts 1–5 be suppressed to protect patient confidentiality. Due to small numbers, the not tested and unknown if tested status categories were combined to allow greater detail to be displayed. The number and percent of homicide victims under the age of 12 not tested/unknown were suppressed due to small cell sizes. Additionally, the not tested/unknown category was suppressed among 12–17 year-olds to prevent calculation of suppressed values. Note also that the presence of cannabis as a substance on toxicology tests does not imply that the drug was the proximal substance responsible for the violent death.

HEALTHCARE UTILIZATION

Limitations of the Michigan Outpatient Database (MODB)

The MODB is an event-level dataset (e.g., emergency department visits), therefore it is possible that the same individual is represented multiple times if they had more than one emergency department (ED) visit in a calendar year. The MODB does not include patients who are admitted as an inpatient. Race and ethnicity information is often missing or unreliable, therefore data cannot be reported based on these characteristics. The MODB data for ED visits is not available prior to 2016. We excluded out-of-state ED visits by Michigan residents.

Limitations of the Michigan Inpatient Database (MIDB)

The Michigan Inpatient Database (MIDB) is an event-level dataset; therefore, it is possible that the same individual will be represented multiple times if they were hospitalized more than once in a calendar year. The MIDB does not include patients who are only seen in the emergency department (ED) or held on observation status and never admitted as an inpatient. Race and ethnicity information is often missing and/or unreliable; thus, data cannot be stratified by these characteristics. Caution is also warranted in interpreting changes in rates over time, which may reflect, for example, changes in the International Classification of Diseases (ICD) coding system and/or changes in insurance status, especially for younger ages after passage of the Affordable Care Act (ACA) and Health Michigan plan. We excluded out-of-state hospitalizations among Michigan residents.

Limitations of the Treatment Episode Data Set (TEDS)

It is important to note that there are limitations of the TEDS data, despite it being a comprehensive and very useful database. These limitations are detailed fully online,⁹¹ but we note a few important ones here. First, TEDS data is based on events (i.e., treatment episodes such as going to detox or entering an outpatient program), and therefore these data do not represent individuals who could have been responsible for more than one treatment episode in the data during a calendar year (e.g., a person going to detox multiple times in a year). While TEDS attempts to track treatment episodes that are linked (i.e., transition from residential to outpatient), this is not always possible and a new admission record may actually represent a transfer in care within a single treatment episode. Due to this, the number of treatment admissions reported is likely an overestimate of treatment episodes at TEDS facilities. Given that TEDS does not include all treatment programs in the state (e.g., excludes private pay), data does not represent all cannabis-related admissions, and does not represent the demand for treatment (e.g., waiting lists). TEDS also does not include federal facilities providing treatment such as the Veterans Administration or Bureau of Prisons. Further, only the primary, secondary, and tertiary drugs listed at treatment admission are included in these data and may under-represent cannabis use problems among individuals in treatment.

CRIMINAL JUSTICE AND LEGAL SYSTEM DATA

Limitations of the Judicial Data Warehouse (JDW)

There is a small amount of non-reporting that occurs with the JDW (e.g., information produced by Michigan courts shows that 242 out of 254 court locations reported data to the JDW between 2013 and 2015).⁹² This non-reporting is a limitation of the data and it is unclear how it may impact the estimates produced; however, the stability of the estimates across years and the wide coverage of the JDW supports the efficacy of the estimates.

Limitations of Michigan HIDTA Drug Threat Assessments and Performance Management Process (PMP) Data

There are several limitations of these data. First, note that drug seizures by the High Intensity Drug Trafficking Area (HIDTA) teams do not represent all drug seizures in the state (as state police and other jurisdictions are also involved in cannabis seizures) and that changing trends in seizures could reflect a number of factors. For example, it is important to note that the observed decreases in seizures by HIDTA and Michigan State Police's Domestic Cannabis Eradication and Suppression Program (DCE/SP) may not represent a decrease in cannabis production in Michigan. Instead, the reduction may be affected by lower targeting and investigation of cannabis grow operations by law enforcement, especially due to the Michigan Medical Marihuana Act (MMMA), and will likely continue to decrease with the passage of the Michigan Regulation and Taxation of Marihuana Act. Moreover, law enforcement agencies note that reductions in seizures as well as investigations into organizations trafficking cannabis may be due to increased prioritization of fentanyl, heroin, and crystal methamphetamine investigations, as well as the number of unsuccessful local cannabis prosecutions due to the MMMA.⁷⁶

ECONOMIC INDICATORS

Limitations of HIDTA Drug Trends Survey, Performance Management Process (PMP) Data, and Drug Enforcement Administration (DEA) Trafficking Report

The data pertaining to economic indicators are limited as there is not a systematic method to assess these factors. Data from HIDTA Task Force Team is useful in providing estimates, but it does not represent the entire state. As the retail market for cannabis emerges there will also be a need to track demand and value in this sphere, as well as continued improvements in tracking and understanding the street value of different cannabis products and related economic indicators.

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