Michigan Substance Use Vulnerability Index Documentation

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Executive Summary and Public Health Implications

Overdose and substance use disorder (SUD) are significant and complex public health problems in Michigan. Historically, overdose death data alone have often been used for SUD policy/program planning. The Michigan Department of Health and Human Services (MDHHS) recognizes that many factors influence a community's vulnerability to adverse outcomes associated with substance use and should be considered in policy and program planning.

With this in mind, MDHHS developed the Michigan Substance Use Vulnerability Index (MI-SUVI) as a tool to help guide equitable SUD program and policy decision-making. The MI-SUVI is a single, standardized score that considers multiple factors that influence a community's vulnerability related to substance use, including indicators related to substance use burden, resources, and social vulnerability. The MI-SUVI score is standardized and available at the county and ZIP Code Tabulation Area (ZCTA) levels. Counties/ZCTAs can be assessed by how far above or below the county/ZCTA average they fall in the total MI-SUVI score, as well as in their substance use burden, substance use resources, and social vulnerability scores.

All communities in Michigan are impacted by substance use. The MI-SUVI does not describe "communities" or "bad" communities with regards to substance use, but rather indicates the extent to which a county has been impacted in comparison to others. The MI-SUVI should not be used alone in decision-making but can be used as a strategic starting point for conversation and to highlight the extent to which certain communities may require further outreach or assessment. **Additional information,**

such as local knowledge and additional, relevant data indicators should be included in any SUD-related decision-making.

The MI-SUVI is available at: Michigan.gov/OpioidsData. Questions regarding the MI-SUVI may be addressed to the MDHHS Opioid and Emerging Drugs Unit: *MDHHS-MODASurveillance@michigan.gov*.

Background

Overdose and SUD are significant public health problems in Michigan. Between 1999 and 2020, all drug overdose deaths in Michigan increased sixfold.[1] In recent years, significant federal and state funding has been released to address the overdose crisis, and programs and policies aiming to reduce substance use and overdose have expanded. When considering resource allocation and program expansion for overdose, data are crucial to ensure accurate and equitable targeting of interventions. Historically, overdose death data alone have often been used for policy and program planning. However, many factors beyond overdose deaths influence a community's burdens of, and vulnerability to, adverse outcomes associated with substance use and should be considered in program and policy planning.

Purpose

The purpose of the Michigan Substance Use Vulnerability Index (MI-SUVI) is to consider the diverse factors that influence a community's vulnerability related to substance use to provide a single composite measure of vulnerability that can be used in resource allocation and program/policy planning.

Guiding Principles

The development of the MI-SUVI was guided by the following core principles:

1. Health equity was prioritized in how the tool was developed by giving it equal weighting to burden and resource components.
2. This tool was created with its end goal in mind: usefulness in allocation of resources and program planning.
3. Stakeholder feedback from policy, programmatic, and data partners, as well as individuals with lived experience, was a crucial part of the development process to ensure the tool's relevance, usefulness, and useability.
4. The methodology for creating this score is data-driven, informed by scientific literature, reviewed by experts, and simple enough that it can be understood by the average Michigander.
5. The final version of this tool, and its methodology, is publicly available, so that any interested party or stakeholder can easily access the report for informed decision-making.
6. The tool will be available at the county-level and at least one sub-county geographic level.

Methodology

Framework overview

The methodology for creating the MI-SUVI was informed by a toolkit developed by the Council of State and Territorial Epidemiologists (CSTE) to assist states in developing jurisdiction-level vulnerability

[1] Michigan Substance Use Disorder Data Repository, Michigan Department of Health and Human Services, https://mi-suddr.com/blog/2021/07/13/all-drug-overdose-deaths/

assessments for opioid overdose.[2] This toolkit provides three methodology frameworks for creating vulnerability assessments in public health jurisdictions. The first step in creating the MI-SUVI was determining which vulnerability index methodology was most appropriate for the purpose and use of the MI-SUVI, followed by identifying a list of indicators that were related to the outcome of interest (substance use vulnerability), testing of the indicators, and creating a final model. Stakeholder feedback was key in determining which methodology to use and which indicators were tested for inclusion.

A composite index score (CIS) methodology was chosen for the MI-SUVI.[3] In this methodology, indicators are identified that may influence the final outcome of interest. These indicators are tested before deciding on a final list of indicators to include in the final score. This testing ensures that there are no duplicative indicators, indicators that do not significantly affect the outcome of interest, or poor-quality indicators. Indicators are standardized and may be grouped together to make different components that feed into the final score, and weights may be applied to the final indicators or components before adding them together to create the final score.[2]

Utilizing this methodology, the framework for the MI-SUVI is as follows:

1. The outcome of interest for the CIS is a community's vulnerability to adverse substance use outcomes (referred to as the MI-SUVI)
2. The composite MI-SUVI score consists of the following **three equally weighted components** known to affect substance use disorder and overdose at the individual and community level (Figure 1):
    a. **Substance Use Burden**: negative outcomes associated with SUD that place a burden on individuals and community resources such as the healthcare and justice systems
    b. **Substance Use Resources**: resources available to the community that can be used to address the negative outcomes associated with SUD.
    c. **Social Vulnerability**: a measure of community level characteristics known to be important drivers of health (i.e., social determinants of health)
3. Each of the three components consists of relevant indicators. These indicators were considered for inclusion based on stakeholder feedback and statistical testing and are equally weighted *within* the corresponding component.
    a. Included indicators are standardized by mean and standard deviation (i.e., Z-scores were generated for each indicator; see "Final MI-SUVI Model" and "MI-SUVI Results" sections for explanation of Z-scores and their interpretation).
    b. Indicators are then divided by the total number of indicators in the component and summed together within the component.
    c. The resource component is then inverted, (-1 x Resource Z-score), so that a higher score represents a worse outcome (fewer resources), and then the three components are summed together.

[2]Jurisdiction Level Vulnerability Assessment Toolkit, Council for State and Territorial Epidemiologists, https://resources.cste.org/JVAToolkit_Final_August2021/Home/Composite

[3]Measuring performance: An examination of composite performance indicators, Centre for Health Economics, https://www.york.ac.uk/che/pdf/tp29.pdf

Figure 1. Overview of MI-SUVI Framework

Step 1: Indicator compilation and stakeholder engagement

A key component of this step was engagement with stakeholders; detailed feedback is available in Appendix 1. Stakeholders were given the chance to comment on the overarching MI-SUVI methodology framework and potential data for inclusion in the indicator. The following stakeholder groups were consulted for feedback:

- Michigan Overdose Data to Action (MODA) Surveillance and Prevention Teams
- MODA Stakeholder Group
- Lived Experience Advisory Group
- State Epidemiologic Outcomes Workgroup
- Michigan Drug Epidemiology Workgroup
- MODA Grant Sub-Contractors

Members of these groups consisted of epidemiologists, analysts, prevention program managers, prevention and harm reduction program staff, community health workers, individuals with lived experience, and MDHHS policy staff, among others. Stakeholders were asked if the proposed methodology would be appropriate for measuring substance use vulnerability in communities, if the score would be useful and usable in their work, and for any potential data indicators they felt would be important to consider in assessing a community's vulnerability to substance use. Stakeholders expressed that the MI-SUVI methodology framework was appropriate, and that the MI-SUVI score would be useful and usable in their work.

Based on stakeholder feedback, a review of scientific literature, and subject matter expertise, 26 potential indicators were able to be constructed and considered for inclusion in the MI-SUVI (see Appendix 2 for more detailed descriptions of these indicators)

1. Opioid Prescription Units > 90 Morphine Milligram Equivalents (MMEs) Prescribed per 1,000 Residents
2. Emergency Medical Service (EMS) Opioid Overdose Responses per 100,000 Residents
3. 5-Year Average of New Hepatitis C Virus (HCV) Infections among Young Adults per 100,000 Residents
4. 3-Year Drug Use-related Skin and Soft Tissue Infection Emergency Department (ED) Visits per 100,000 Residents
5. Drug Related Crashes per 100,000 Residents
6. Median Number of Days from Treatment Request to Receiving Publicly Funded SUD Treatment

7. Publicly funded SUD Treatment Admissions per 100,000 Residents
8. Pharmacies Participating in Naloxone Standing Order per 100,000 Residents
9. Naloxone Kits Ordered from MDHHS Naloxone Portal Order per 100,000 Residents
10. Percent of Opioid Overdose EMS Responses where Naloxone was Administered Prior to EMS Arrival
11. Operating EMS Agencies per 100,000 Residents
12. Percent of Population within 30 Minute Drive of Treatment Center
13. Area Deprivation Index
14. Percent of Population that Commutes to Work via Public Transportation
15. 5-Year Average Overdose Death Rate per 100,000 Residents
16. 3-Year Average Nonfatal Overdose ED Visit Rate per 100,000 Residents
17. Drug Related Arrest Rate per 100,000 Residents
18. Opioid Prescription Units Prescribed per 1,000 Residents
19. Percent of Population within 30 Minute Drive of Publicly funded Treatment Center
20. Percent of Population within 15 Minute Drive of a Syringe Service Program (SSP)
21. Buprenorphine Prescription Units Prescribed per 1,000 Residents
22. Social Vulnerability Index (SVI)
23. Percent of Households without Computer with Internet Access
24. Percent of Non-institutionalized Civilians without Health Insurance Coverage
25. Percent of Population within 30 Minute Drive of Acute Care Hospital
26. Percent of Population within 15 Minute Drive of Pharmacy

Step 2: Analysis of indicators for inclusion

Indicators were tested for inclusion in the MI-SUVI at the county level, in the following ways:

1. Calculating the correlation between indicators considered for inclusion within each component
    - If two indicators were moderately to strongly correlated (Spearman correlation coefficient of $r>0.4$), one of the indicators was eliminated. To determine which indicator was kept, relevance and parsimoniousness were considered.
        i. Fatal overdose rate and the non-fatal overdose ED visit rate were both included despite their correlation. While these indicators were strongly correlated (0.6), both indicators are known to strongly affect community's substance use burden in different ways (healthcare system burden for non-fatal data, years of life lost and family structure impacts for fatal data); thus, it was decided to keep both indicators.
2. Assessing the spread of data for each indicator across counties
    - If variation did not exist within the indicator across counties based on the data range (maximum value minus the minimum value), it was removed from consideration.
        i. For indicators that were percentages (e.g., percent of population within 15-minute drive of SSP), the data range needed to be at least 10% for the indicator to be considered sufficiently varied.

ii. For indicators that were rates (e.g., fatal overdose rate), the data range (maximum value minus the minimum value) needed to be at least twice that of the minimum value for the indicator to be considered sufficiently varied.

3. Assessing the quality of the data source
    - If the data source limitations were such that the indicator could not truly measure the outcome of interest, the indicator was removed.
    - An example of an indicator removed for poor data quality was naloxone kits ordered from the MDHHS naloxone portal per 100,000 county residents. The intent of the indicator was to assess naloxone availability in a county. Since this indicator is based on naloxone ordered by organizations who can cover multiple counties, it was unable to be accurately used to reflect county-level naloxone distribution.
4. Testing the impact of the indicator on the MI-SUVI model by viewing county-level MI-SUVI rankings when the MI-SUVI did and did not include the indicator
    - A core MI-SUVI model was constructed with five indicators (fatal overdose rate, non-fatal overdose rate, SSP access percentage, treatment access percentage, and SVI). These five are known to significantly impact SUD at the community-level based on the scientific literature[4]. Counties were then ranked by percentile based on this base model.
    - Additional indicators were then tested by adding each individual indicator to the MI-SUVI model. Indicators that did not cause ten or more counties to change in percentile rank were considered as not influencing the model outside of the already included indicators and were not included.
5. Considering the geographic availability of the data
    - If the indicator was not available at a sub-county geographic level, then it was either not used, an alternate indicator was included, or an imputation measure was used.

See Appendix 2 for full list of indicators considered for inclusion, their data sources, and rationale for inclusion or exclusion.

Step 3: Final MI-SUVI Model

After testing was conducted, eight indicators were included for selection in the Michigan MI-SUVI. Figure 2 represents the final model including these eight indicators:

Figure 2. Final MI-SUVI Model with Included Indicators*

$$\textbf{\textit{Substance Use Burden}} = \left[\left(\frac{OD\ Death\ Rate + Nonfatal\ OD\ ED\ Visit\ Rate + Opioid\ Prescribing\ Rate + Drug\ Related\ Arrest\ Rate}{4}\right)\right]$$

[4] Amaro, H., Sanchez M., Bautista, T., Cox, R., Social vulnerabilities for substance use: Stressors, socially toxic environments, and discrimination and racism. https://www.sciencedirect.com/science/article/pii/S0028390821000721;
Centers for Disease Control and Prevention. Evidence-Based Strategies for Preventing Opioid Overdose. https://www.cdc.gov/drugoverdose/pdf/pubs/2018-evidence-based-strategies.pdf;
Shiels, M.S., de Gonzalez, A.B., Best, A.F., et al. Premature mortality from all causes and drug poisonings in the USA according to socioeconomic status and rurality. https://www.sciencedirect.com/science/article/pii/S2468266718302081?via%3Dihub

$$\textbf{\textit{Substance Use Resources}} = \left[-1 \times \left(\left(\frac{\begin{array}{c}(\%\ of\ population\ within\ 30\ Min\ Drive\ of\ Treatment\ Center + \\ \%\ of\ population\ within\ 15\ Min\ Drive\ of\ SSP + \\ Buprenorphine\ Prescribing\ Rate\end{array}}{3} \right) \right) \right]$$

$$\textbf{\textit{Social Vulnerability}} = [Modified\ Social\ Vulnerability\ Index]$$

$$\textbf{\textit{MI - SUVI}} = Substance\ Use\ Burden + Substance\ Use\ Resources + Social\ Vulnerability$$

Standardization Methodology

Before summing indicators within components, indicators were standardized to Z-scores. A Z-score methodology was chosen for standardization since Z-scores preserve the magnitude of the differences between counties, as opposed to a rank or percentile rank, which assign an equal difference to each rank. The Z-score methodology preserves outliers, which were of interest to this analysis.[5] For example, if most counties have between 70% - 90% of their population within a 30-minute drive time to SUD treatment, but one county only has 10% of their population with such access, a Z-score methodology would retain the size of that inequity whereas rank would not.

The following is an example of how a Z-score is calculated for a county:

$$\frac{[County\ "A"\ Overdose\ Rate] - [Mean\ County\ Overdose\ Rate]}{[Standard\ Deviation\ of\ County\ Overdose\ Rates]} = \textbf{\textit{County "A" Overdose Z-Score}}$$

After adding the three components together, the summed score is then standardized to a Z-score to form the final MI-SUVI score. Here, the mean does not indicate ideal but serves as a reference point.

[5] Measuring performance: An examination of composite performance indicators, Centre for Health Economics, https://www.york.ac.uk/che/pdf/tp29.pdf

Overview of Indicator Calculations

Table 1 below summarizes how included indicators were calculated for inclusion in the model.

Table 1. Indicators included in the MI-SUVI, indicator case definitions, and calculation descriptions

Indicators	Numerator Case Definition	Calculation
5-Year Average Overdose Death Rate per 100,000 Residents	Death certificates with an underlying cause of death ICD-10 Code of: X40-X44, X60-X64, X85 or Y10-Y14, by Decedent Residence	(Overdose Deaths among Residents / Resident Population) x 100,000
3-Year Average Nonfatal Overdose ED Visit Rate per 100,000 Residents	ED visits with an ICD-10-CM diagnosis code of: T36-T50, limited to initial visits for poisonings, by Patient Residence	(Nonfatal Overdose ED Visits among Residents / Resident Population) x 100,000
Opioid Prescription Units Prescribed per 1,000 Residents	Prescription Units of Opioid Agonists and Partial Agonists Not Used for OUD Treatment, by Patient Residence	(Opioid Prescription Units Dispensed among Residents / Resident Population) x 1,000
Drug Related Arrest Rate per 100,000 Residents	Offences Listed as Drug Related Occurring in and Arrested in Year of Interest by Area of Occurrence	(Arrests for Drug Related Offences Occurring in Area / Resident Population) x 100,000
Percent of Population within 30 Minute Drive of Publicly Funded Treatment Center	Populations of Census Tracts Within a 30 Minute Drive Time Polygon of Geocoded Treatment Center Locations[a,b]	(Number of Residents within 30 Minute Drive of Treatment Center / Total Resident Population) x 100
Percent of Population within 15 Minute Drive of SSP	Populations of Census Tracts Within a 15 Minute Drive Time Polygon of Geocoded SSP Locations [a,b]	(Number of Residents within 15 Minute Drive / Total Resident Population) x 100
Buprenorphine Prescription Units Prescribed per 1,000 Residents	Prescription Units of Buprenorphine, by Patient Residence	(Buprenorphine Prescription Units Dispensed among Residents / Resident Population) x 1,000
Social Vulnerability Index	*See "Social Vulnerability Index" Section Below*	

Abbreviations: OD=Overdose, ICD-10(-CM)=International Classification of Disease, 10th Revision, (Clinical Modification), OUD=Opioid Use Disorder

Denominator/Population Data: All denominator and population data use National Center for Health Statistics Bridged-Race Population Estimates, Vintage 2020.

Crude Rate: A crude rate is defined as the total number of events, or count, divided by the total population of the selected geography and multiplied by a constant, here, that constant is 100,000.

[a] Drive time polygons created using the HereR package in R

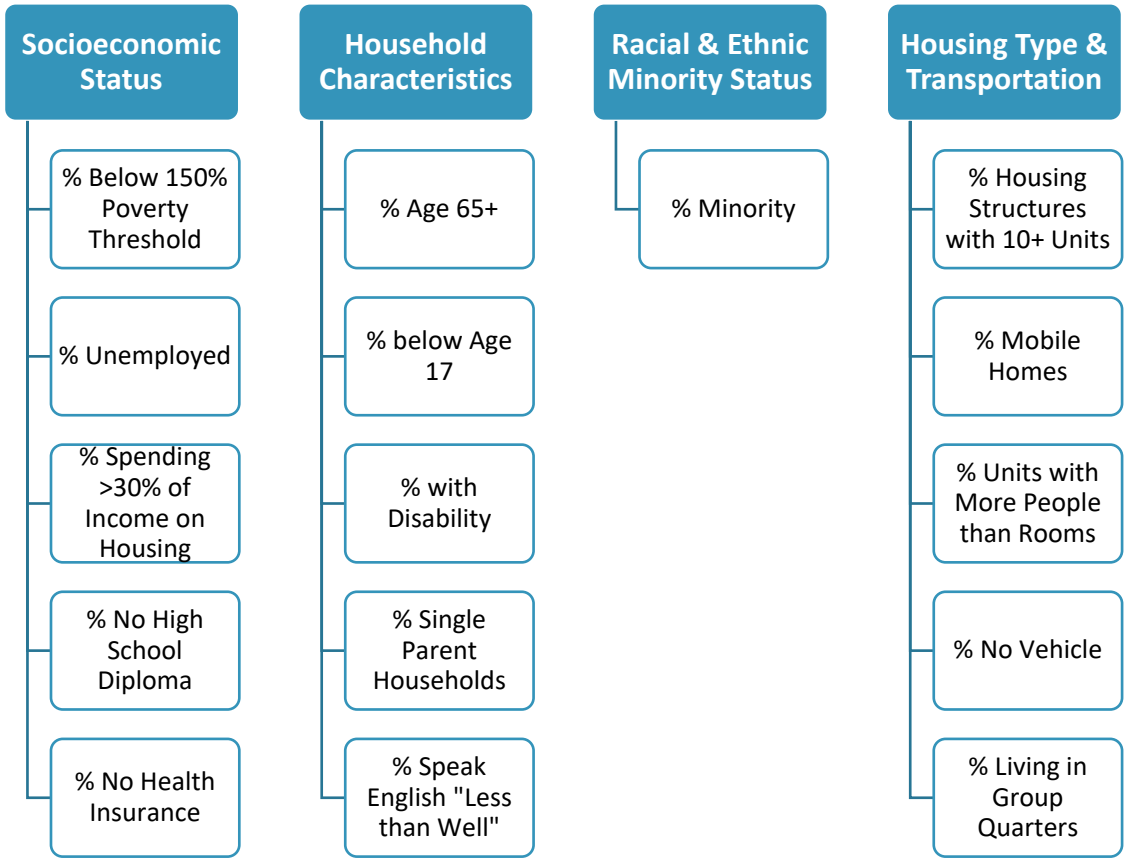
[b] SSP and SUD treatment centers along borders of states adjacent to Michigan were considered in drive-time analyses.

Social Vulnerability Index

The Social Vulnerability Index (SVI) is a composite indicator created by the Centers for Disease Control (CDC) that assesses indicators of social vulnerability (social characteristics of communities that can lead to negative effects on community health and welfare) to identify communities that may be at higher risk

during disasters.[6] Sixteen census variables are a part of the SVI score, making up four "themes" (see Figure 3). Indicators within each theme are standardized by percentile rank, and then added together within themes to create the composite theme score. To create the SVI score, the theme composite scores are summed and then standardized to percentile rank. Relevant indicators are inverted.

Figure 3. CDC Social Vulnerability Index Themes and Indicators

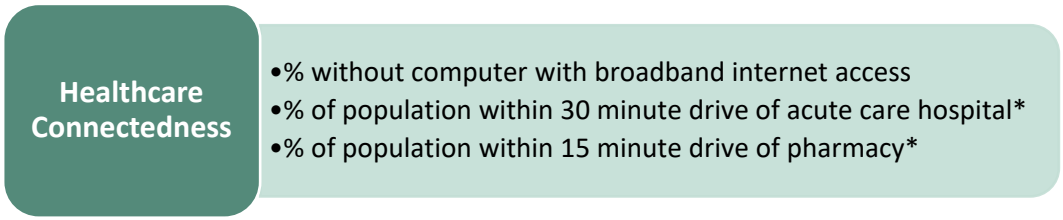


In the feedback process, stakeholders overall were pleased with the inclusion of the SVI and the indicators included in the SVI. Stakeholders felt there were several other social characteristics of communities that were important factors in how communities and individuals responded to SUD. Based on this feedback, and the methodology chosen for the MI-SUVI, the CDC SVI was modified in the following ways to incorporate it into the MI-SUVI:

1. SVI indicators were standardized to Z-scores before summing, rather than percentile ranks, to match the MI-SUVI standardization methodology.

[6] CDC/ATSDR Social Vulnerability Index, Centers for Disease Control and Prevention, https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

2. A fifth theme relating to "Healthcare Connectedness" was added to the SVI, composed of the following data:



*Hospitals/pharmacies along borders of states adjacent to Michigan were included.

With the above three changes incorporated, this indicator is referred to in the final MI-SUVI model as the "modified SVI".

Sub-County MI-SUVI Data: ZIP Code Tabulation Areas

Once the methodology for the MI-SUVI was finalized, the methodology was applied to the ZIP code level, in order to fulfill the principle of having the MI-SUVI available at a sub-county level for more granular decision-making.

ZIP codes, census tracts, and county subdivisions (CSDs) were all considered for sub-county MI-SUVI scoring. ZIP codes were chosen as all eight indicators either had ZIP code level data available (overdose, prescription, and arrest rates) or were able to be calculated at the ZIP code level (resource drive times and SVI). If census tracts or CSDs were used, available ZIP code data for the five overdose, prescription, or arrest-related indicators would have had to be converted to the chosen sub-county level, which could generate imprecise results, as some ZIP codes span multiple census tracts or MCDs, while some census tracts or county subdivisions include multiple ZIP codes which would have to be aggregated. Additionally, local health department staff suggested that ZIP codes were easier to interpret and visualize within their communities than census tracts.

MI-SUVI ZIP Code Methodology

ZCTAs are geographic representations of ZIP codes created by the Census Bureau and are approximations of ZIP code mailing route boundaries. ZIP codes are not geographic areas but are rather a collection of mailing addresses associated with post office service routes, thus, ZCTAs were used as the unit of analysis. The majority of ZTCAs are the same as ZIP codes (986/1158 (85%) ZIP codes in Michigan in 2021 matched the Census assigned ZTCA value).

Fatal overdose, nonfatal overdose, opioid prescribing, buprenorphine prescribing, and drug-related arrest data all included ZIP code of residence. These ZIP codes were converted to ZCTAs using the Uniform Data Systems 2021 ZIP Code to ZCTA crosswalk.[7] Rates were calculated using ACS 5-year total population estimates (variable S0601_C01_001E) by ZCTA as denominators. SUD treatment and SSP access variables and modified SVI were re-calculated using ACS data at the ZCTA level.

ZCTA data were standardized and consolidated into the composite MI-SUVI score using the same methodology as county-level scoring, apart from the exclusion of drug-related arrest data (see "Missing/Excluded ZIP Code Data" for rationale).

[7]ZIP Code to ZCTA Crosswalk, UDS Mapper, https://udsmapper.org/zip-code-to-zcta-crosswalk/

Missing/Excluded ZIP Code Data

ZIP code information was missing or invalid:

- on average, in 1% of death records per year in the 5-year fatal overdose rate
- on average, in 0.03% of ED records per year in the 3-year nonfatal overdose ED visit rate
- 0% of the time in opioid and buprenorphine prescription data
- 27% of the time in the 2020 drug-related arrest data
    - The available number of drug arrests by ZIP code was cross-walked to county data and then compared to the number of drug arrests by county to determine if missing was at random or systematic across counties. This comparison determined that missingness was not at random, with certain counties more impacted by missingness than others.
    - Due to the high level of missingness, and the non-uniform missingness by county, drug-related arrest data were not included in MI-SUVI calculations by ZCTA.

ZCTAs that had 0 population within the past five years (2016-2020) or that had 0 population, 0 households, or 0 housing units in 2020 were excluded from the analysis (16 ZIP codes: 48233, 48242, 48243, 48397, 48551, 48553, 48554, 48667, 48710, 48825, 48921, 49084, 49104, 49434, 48143, 49666). 971 ZCTAs remained for analysis after this exclusion.

Three ZCTAs had insufficient samples to calculate an estimate of the percent of population unemployed in the SVI calculations (48411, 48630, 49320). For these ZCTAs, the median unemployment percent by ZCTA was assigned as an imputation.

ZIP Code Tabulation Area Considerations

ZIP codes are subject to changes as postal routes change, which may cause discrepancies between the known area of the ZIP code and the ZCTAs included for analysis in this workbook.

MI-SUVI Results

MI-SUVI results are available on Michigan.gov/OpioidsData in the following formats:

1. Maps of the results, county profiles, and comparisons of indicators used to build the MI-SUVI are available on the Michigan Overdose Data to Action dashboard.
2. An Excel document of the raw data used to create the score, as well as the final MI-SUVI statistics, ranks, and percentile ranks is available for download below the dashboard (for both county and ZCTA data).

MI-SUVI Year

The current version of the MI-SUVI is based on 2020 data (although SSP and treatment center data is based on 2021 data, which was the only data available at the time of development). A 2021 version of the MI-SUVI will be released once all data sources have complete 2021 data (typically at the end of the following calendar year).

Interpretation

The final MI-SUVI score is presented as a **Z-score**. Z-scores are used to standardize an indicator by the mean and standard deviation of the data and measure how far above or below average the indicator is. The MI-SUVI score for a county measures how far above or below the average county substance use vulnerability a county is. For example, if County X has a MI-SUVI score of 2.5, this means that the County

X's MI-SUVI score is 2.5 times above the average county MI-SUVI score. If County Y has a MI-SUVI score of 0.1, this means that County Y's MI-SUVI score is comparable to the county average. County X is substantially higher in substance use vulnerability than County Y, which is approximately average in substance use vulnerability. Similarly, the MI-SUVI score for a ZCTA measures how far above or below the average ZCTA substance use vulnerability a ZCTA is. All counties/ZCTAs are impacted by SUD; this index does not describe "good" vs "bad" counties/ZCTAs for SUD interventions or imply that the county/ZCTA average is a sufficient goal to strive for, but rather indicates the extent to which a county/ZCTA has been impacted *in comparison to* other counties/ZCTAs.

A Z-score is a relative measure tied to a mean that provides information regarding how counties/ZCTAs compare to each other. To assess "improvement" in an area, each indicator can be tracked over time for the given area. For example, decreases in the Drug Related Arrest Rate or Overdose Death Rate statistic would be an "improvement" for that area.

MI-SUVI counties/ZCTAs data are also available as a rank (county: 1 to 83, ZCTA: 1 to 971), with 1 being the most vulnerable county and 83/971 being the least vulnerable county, and as a percentile rank (1-100), with higher percentiles corresponding to a higher MI-SUVI score and being more vulnerable.

Data Limitations

General MI-SUVI Limitations

As mentioned in the executive summary, the MI-SUVI is not meant to be the sole consideration for decision-making in the SUD space. The MI-SUVI is a starting point for discussing how to equitably allocate resources and choose communities for interventions. As such, the MI-SUVI should be used in conjunction with local data, subject matter expertise and additional relevant data indicators in decision-making. All components and indicators that make up the MI-SUVI are available to view in the dashboard and Excel document of results; these individual indicators are additionally important to consider when planning programs and policies.

Additionally, the individual indicators that comprise the MI-SUVI have limitations that may have implications for MI-SUVI interpretation in communities. Please see below limitations of the included indicators and take them into account in any decision-making.

Included Data Indicator Limitations

5-Year Fatal Overdose Rate

This indicator may not be reflective of the most recent trends in fatal overdoses in communities, as it is a 5-year average and more likely to measure historical trends in overdose. Additionally, some rates may have small numerators (1-5), which may lead to unstable results. A 5-year average was chosen to create more stability in estimates with small numerators, but some communities may still have unstable results with small numerator counts.

3-Year Non-Fatal Overdose ED Visit Rate

This indicator may not be reflective of the most recent trends in non-fatal overdoses in communities, as it is a 3-year average and more likely to measure historical trends in overdose. One major hospital in Washtenaw County does not report emergency department data. This likely leads to under-reporting of

nonfatal overdoses in Washtenaw County and should be taken into consideration when interpreting Washtenaw County data. Additionally, these data measure ED visits, not individuals, and an individual may be in the dataset multiple times if they sought care in the ED for overdose multiple times during the 3-year period. This dataset does not capture non-fatal overdoses that did not present to the ED for care.

Opioid Prescription Units Rate

This indicator is only able to measure the amount of opioids being prescribed to a community, not how many opioids are being inappropriately used or diverted. It cannot capture illicit opioid use, and it does not capture other drug prescriptions besides opioids that may be diverted or misused.

Drug-Related Arrest Rate

This indicator may not capture all drug-related arrests if the drug-related incident occurred in 2020 but the individual was not officially arrested until after 2020. If an individual was arrested on multiple charges, the individual will only appear in the dataset for the more serious offense. Therefore, individuals who were arrested for both a drug-related offense and a more serious offense are not included in this indicator. Additionally, more arrests can be the result of more policing in areas, or bias in certain populations or communities, and not necessarily indicative or greater drug presence in those populations/communities.

Treatment Access Percentage

This indicator only captures proximity to publicly funded treatment centers, not private treatment facilities. Different types of treatment centers (residential vs detox vs outpatient) are not reported separately in this indicator.

SSP Access Percentage

This indicator presents SSPs as static locations, but some SSPs are mobile. In these cases, effort was taken to denote a specific location for each area the SSP served, but it is possible that not all locations serviced by a mobile SSP were captured in this data indicator. This indicator additionally does not stratify by types of services and interventions available by various SSPs.

Buprenorphine Prescription Units Rate

This indicator is only able to measure buprenorphine in communities as an indicator of medication for opioid use disorder (MOUD) treatment; methadone clinics and methadone as MOUD data are not available for analysis in the MI-SUVI. Research has found that buprenorphine is more likely to be prescribed in white, higher SES communities, while methadone is more available in lower income and Hispanic communities.[8] This bias may skew the MI-SUVI resources results.

Modified SVI

This indicator heavily relies on American Community Survey (ACS) data, which are survey data, and is not based on an exact census of every household in the United States. As these data are survey estimates, uncertainty exists in the estimates included in the SVI. While survey estimates likely approximate true estimates, this uncertainty should be considered, particularly at smaller geographic

[8] Hansen, H.B., Siegel, C.E., Case, B.G, et al. Variation in use of Buprenorphine and Methadone Treatment by Racial, Ethnic and Income Characteristics of Residential Social Areas in New York City. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3818282/

levels than county. Further, for geographic groupings larger than a census tract, communities become less homogenous in terms of demographics and socioeconomic status. This allows for the possibility of aggregating data for dissimilar groups in a single geography and could obscure socially disadvantaged groups in certain areas.

ZCTA Limitations

ZCTAs are geographic representations of ZIP code postal routes, which can change over time. This may lead to discrepancies between ZIP codes available in the MI-SUVI analysis and the true ZIP code associated with an address. Additionally, as ZCTAs are based on mailing routes and are not based on neighborhood or population characteristics, ZCTAs may be comprised of non-homogenous populations, which may obscure disparities in groups within ZCTAs when data are aggregated (see ZCTA methodology section for explanation on why ZCTAs were chosen).

MI-SUVI Suggested Citation

Michigan Department of Health and Human Services. (2022). Michigan 2020 Substance Use Vulnerability Index (Version 1). [Data file]. Retrieved from: Michigan.gov/OpioidsData.

Contact Information

If you have questions regarding the MI-SUVI, please reach out to the MDHHS Opioid and Emerging Drugs Unit: *MDHHS-MODASurveillance@michigan.gov*.

Appendix 1: Stakeholder feedback

Stakeholders provided feedback regarding two phases of the MI-SUVI development, creating a comprehensive list of indicators to explore for inclusion and then in the design of the dashboard page to ensure readability and user-friendly design.

The following stakeholder groups were consulted for feedback:

- Michigan Overdose Data to Action (MODA) Surveillance and Prevention Teams
- MODA Stakeholder Group
- Lived Experience Advisory Group
- State Epidemiologic Outcomes Workgroup
- Michigan Drug Epidemiology Workgroup
- MODA Grant Sub-Contractors

Members of these groups consisted of epidemiologists, analysts, prevention program managers, prevention and harm reduction program staff, community health workers, individuals with lived experience, and MDHHS policy staff, among others.

To create a comprehensive list of indicators and to ensure the appropriateness of the MI-SUVI methodology, feedback was gathered via a live webinar with time for questions and comment. This phase was completed prior to any indicator testing. A sampling of direct quotes from stakeholders includes the following:

- *"Also look for internet/wifi access, as in the rural counties we are trying to continue with telehealth for some of the follow-up visits."*
- *"Drive time or miles? (15 miles? has been used in pharmacy access studies)"*
- *"It depends on the service, you should split SSPs and treatment centers"*
- *"It's wise to keep in mind a more simple analysis method, it's hard to communicate complex methods to partners."*

To assess dashboard design, stakeholders were provided with a live demonstration of the draft dashboard, followed by a period for questions and feedback. Stakeholders expressed positive feedback about the MI-SUVI and that the MI-SUVI score would be useful and usable in their work. Several comments about interpretation led to updated language for the "County Scorecard" tab. A sampling of direct quotes from stakeholders includes the following:

- *"The "Compare Data Points" tab is brilliant."*
- *"I love it!"*
- *"This will be so useful."*

Throughout the MI-SUVI development process, a team of epidemiologists, analysts, and program staff met on a weekly basis and discussed methodology, feedback, indicator selection, results, and dissemination efforts/products. These staff were viewed as subject matter experts and regularly given opportunities to comment and provide direction on the MI-SUVI development.

Appendix 2: Indicators Considered for Inclusion

Table 2. Indicators included in the MI-SUVI, the indicator data source, the indicator component, and rationale for including the indicator.

Indicators Included in MI-SUVI			
Indicator	**Data Source**	**Component**	**Rationale**
5-Year Average Overdose Death Rate per 100,000 Residents	MI Resident Death Files, 2016-2020	Burden	Overdose deaths represent a severe outcome of substance use, are available at geographically granular levels, and are completed for all deaths of Michigan residents.
3-Year Average Nonfatal Overdose ED Visit Rate per 100,000 Residents	MI Inpatient and Outpatient Databases, 2018-2020	Burden	This indicator measures nonfatal overdoses treated in emergency departments (ED), thus measuring burden of substance use on healthcare systems in communities. Over 90% of EDs report to this data source.
Drug Related Arrest Rate per 100,000 Residents*	MI Incident Crime Reporting, 2020	Burden	While this indicator has some limitations (more arrests can be related to more policing), it provides a measure of the burden that substance use places on a community's justice system and may indicate drug presence in communities.
Opioid Prescription Units Prescribed per 1,000 Residents	Michigan LARA Utilization Reports, 2020	Burden	Comprehensive prescribing data are collected for all prescriptions in MI; this measures the amount of opioids prescribed in a community, which can be a risk factor for new addiction and drug diversion.
Percent of Population within 30 Minute Drive of Publicly Funded Treatment Center	SAHMSA Treatment Provider Registry	Resource	This indicator measures how accessible OUD treatment is to residents based on treatment center proximity. This is a comprehensive measure based on federal regulated SAHMSA providers and census data.
Percent of Population within 15 Minute Drive of SSP	MDHHS SSP Locator	Resource	This indicator measures how accessible SSP programs are to residents based on proximity to an SSP. This measure is comprehensive in that it captures all SSPs in Michigan and uses census data.
Buprenorphine Prescription Units Prescribed per 1,000 Residents	Michigan Automated Prescription System, 2020	Resource	Comprehensive prescribing data are collected for all prescriptions in Michigan. This indicator measures the amount of medication prescribed for SUD in a community.

Social Vulnerability Index	Centers for Disease Control, 2020	Social Vulnerability	This indicator measures the relative social vulnerability of communities based on 15 census variables. It provides a robust measure of social determinants of health and fulfills the guiding principle focused on equity.
% of Households without Computer with Broadband Internet Access	American Community Survey, 5-Year Data, 2020	Social Vulnerability	This indicator is a census variable that measures access to technology that is necessary for individuals to connect with healthcare providers and receive support from peer counselors.
% of Non-institutionalized Civilians without Health Insurance Coverage	American Community Survey, 5-Year Data, 2020	Social Vulnerability	This indicator is a census variable that measures health insurance status, which is essential for accessing healthcare services.
Percent of Population within 30 Minute Drive of Acute Care Hospital	Hospital Master List, Opioid and Emerging Drugs Unit, MDHHS	Social Vulnerability	This indicator measures how accessible treatment and emergency care at an acute care hospital are to residents based on proximity to a hospital. This measure is comprehensive in that it captures all facilities within the Certificate of Need regulatory program providing care in MI and uses census data.
Percent of Population within 15 Minute Drive of Pharmacy	MI LARA Pharmacy Registry, 2020	Social Vulnerability	This indicator measures how accessible pharmacies are to residents based on proximity to a pharmacy. This measure is comprehensive, capturing all active pharmacies licensed by the licensing and regulatory agency and uses census data.

Note: Indicators within components did not have a Spearman correlation coefficient greater than 0.4, except for the fatal and non-fatal overdose indicators, and indicators within the modified SVI (these exceptions were allowed based on the importance of both fatal and nonfatal overdose and based on the CDC SVI development methodology). All indicators were considered moderate to high data quality (comprehensive with regards to data collection across the entire state, and able to capture the intended indicator without bias). All indicators are available at the county and ZIP code level, and all indicators had sufficient variation of data within the indicator based on the criteria outlined in the methodology section.

*Drug-related arrest rate only included in county-level MI-SUVI scoring; this indicator is not included in ZCTA MI-SUVI calculations.

Table 3. Indicators investigated for inclusion but not selected for inclusion in the MI-SUVI, the data source of indicators, the component the indicator is a part of, and the reason for not including the indicator in the MI-SUVI.

Indicators Not Included in MI-SUVI			
Indicator	**Data Source**	**Component**	**Rationale**
Opioid Prescription Units > 90 Morphine Milligram Equivalents (MMEs) Prescribed per 1,000 Residents	Michigan Automated Prescription System, 2020	Burden	This indicator is strongly correlated with opioid prescriptions (0.71). Additionally, recent CDC prescribing guidelines have shifted away from using a 90 MME cutoff for risky prescribing, meaning this likely does not capture the intended indicator (high risk prescriptions).
EMS Opioid Overdose Responses per 100,000 Residents	MI Emergency Medical Information System, 2020	Burden	This indicator is moderately to strongly correlated with fatal and non-fatal overdoses (0.56 and 0.66, respectively). Additionally, this indicator only considers opioid overdoses, not all drug overdoses.
5-Year Average of New Hepatitis C Virus (HCV) Infections among Young Adults per 100,000 Residents	MI Disease Surveillance System, 2016-2020	Burden	This indicator is moderately correlated with both opioid prescribing rate (0.47) and drug arrest rate (0.40), both of which are recommended for inclusion in score. This indicator is primarily related to injection drug use, not all drug use, and is only relevant to a subset of the MI population (young adults). Additionally, sensitivity testing showed that this indicator did not influence the MI-SUVI outside of the core indicators (see methodology section).
3-Year Drug Use-related Skin and Soft Tissue Infection ED Visits per 100,000 Residents	MI Inpatient and Outpatient Databases, 2018-2020	Burden	SUD sequelae rate is moderately to strongly correlated with the overdose death rate (0.42) and overdose ED visit rate (0.69). Additionally, this indicator is primarily related to injection drug use, not all drug use.
Drug Related Crashes per 100,000 Residents	Michigan Traffic Crash Facts, 2020	Burden	This indicator may capture alcohol-impaired driving which is not the intent of this index. Further, the indicator does not distinguish between drug presence vs drug impaired driving.
Median Number of Days from Treatment Request to Receiving Publicly Funded SUD Treatment	Treatment Episode Dataset, 2020	Resource	Both indicators are not available below the county level. Additionally, sensitivity testing showed that this indicator did not influence the MI-SUVI outside of the core indicators (see methodology section).
Publicly Funded SUD Treatment Admissions per 100,000 Residents	Treatment Episode Dataset, 2020	Resource	

Pharmacies Participating in Naloxone Standing Order per 100,000 Residents	MI Naloxone Standing Order Database, 2020	Resource	Indicator was viewed as poor quality, as it does not reflect actual naloxone distribution by a pharmacy, and the indicator intent was to capture naloxone availability.
Naloxone Kits Ordered from MDHHS Naloxone Portal Order per 100,000 Residents	MI Naloxone Portal, 2020	Resource	Indicator was viewed as poor data quality, as kits are often distributed at the regional level, and data would need to be imputed to the county and sub-county levels based on population size, which may not actually reflect where the kits were distributed.
Percent of Opioid Overdose EMS Responses where Naloxone was Administered Prior to EMS Arrival	MI Emergency Medical Information System, 2020	Resource	Indicator was viewed as poor data quality, as prior medication administered is often not completed. Additionally, indicator is correlated with the treatment access percent indicator (0.53).
Operating EMS Agencies per 100,000 Residents	MI Emergency Medical Information System, 2020	Resource	Indicator is moderately to strongly correlated with treatment access percent (-0.63) and SSP access percent (-0.41).
Percent of Population within 30 Minute Drive of Treatment Center	MI Naloxone Standing Order Database, 2020	Resource	Indicator is very strongly correlated with treatment access proportion (0.81) and pharmacy access proportion (0.94), both of which are recommended for inclusion. Including this indicator would be duplicative.
Area Deprivation Index	Neighborhood Atlas, University of Wisconsin, 2019	Social Vulnerability	Indicator not recommended as it cannot be re-created at different geographic levels, updated with more recent data, nor does it include race.
Percent of Population that Commutes to Work via Public Transportation	American Community Survey, 5-Year Data, 2020	Social Vulnerability	Indicator does not have sufficient variation (percent range is 5%); proxy measure may not reflect actual public transportation availability. Additionally, a transportation measure already exists in the SVI.

Note: If two indicators were moderately to strongly correlated (Spearman correlation coefficient of $r>0.4$), one of the indicators was eliminated to prevent including duplicative indicators.