

Ottawa County COVID-19 Epidemiology

March 2, 2023

Data as of February 25, 2023, unless otherwise indicated.

Executive Summary

- Weekly reported cases in the US and in Michigan are stable and relatively low
- Ottawa County transmission signals may be showing slight increases
 - Last week positivity increased to 14.3%, from 13% two weeks ago.
 - Weekly case counts increased 33% (-26% two weeks ago), from 117 two weeks ago to 156 last week.
 - Cases among children increased 150% (-25% two weeks ago), from 6 two weeks ago to 15 last week.
 - COVID-19 wastewater signals in Ottawa County are mixed. In Holland/Zeeland the latest signals are stable; Grand Haven/Spring Lake signals are decreasing, and Allendale signals are mixed.
 - Based on national data, a variety of Omicron subvariants are likely circulating.
 - Ottawa's CDC Community Level is LOW.
 - Ottawa's CDC Transmission Level is HGH as of March 2, 2023.
- Ottawa-area and regional hospitals have adequate capacity
 - In Ottawa County, 4% of all available beds and 0% of all ICU beds are occupied by COVID-19 patients.*
- Pediatric hospitalization rates in the US and in Michigan remain relatively low
 - Regional COVID-19 pediatric hospitalization census remains low compared to the late 2021 and early 2022 Omicron surge.
- Of Ottawa County residents aged 6 months and older, 61.7% have received their primary vaccine series.

^{*}Some hospitals in Ottawa County immediately transfer acutely ill adults or children to regional hospitals that offer a higher level of care. This practice may reduce the proportion of beds occupied by COVID-19 patients in Ottawa and increase bed occupancy in urban centers with large hospitals, such as Kent County.

Limitations

Case Counts, Case Rates, and Test Positivity

With the widescale availability of at-home antigen tests for COVID-19, which are not reported or included in public health surveillance data, the case counts and case rates in this report underestimate the true burden of this disease. However, it is expected that increasing and decreasing trends reflect the relative amount of transmission in the community.

Wastewater Surveillance

Wastewater samples are collected from specific geographic sites in the county and may not reflect COVID-19 burden across the entire county population. However, increases and decreases in detected trends generally correlate with case rates, therefore wastewater readings are displayed alongside countywide incidence rates in this report.

Ottawa County Metrics by Week

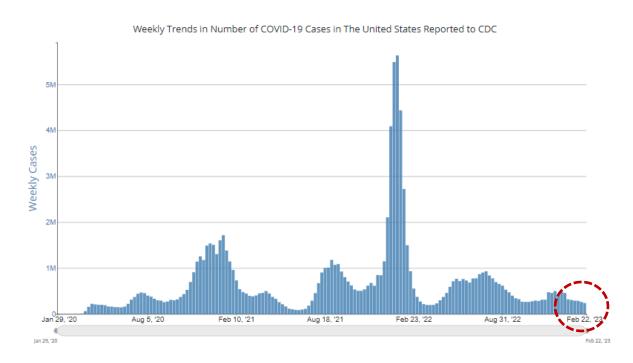
		Week Ending				
Metric	Goal	28-Jan-23	4-Feb-23	11-Feb-23	18-Feb-23	25-Feb-23
Positivity (All Ages)	NA	13.1%	15.3%	14.7%	13.0%	14.3%
Weekly Cases (All Ages)	<592	141	132	159	117	156
Weekly Cases in Children (0-17 years of age)	NA	20	16	8	6	15
Total Deaths (All Ages)	0	5	6	3	1	0
CDC COVID-19 Community Level (New)	Low	Low	Low	Low	Low	Low

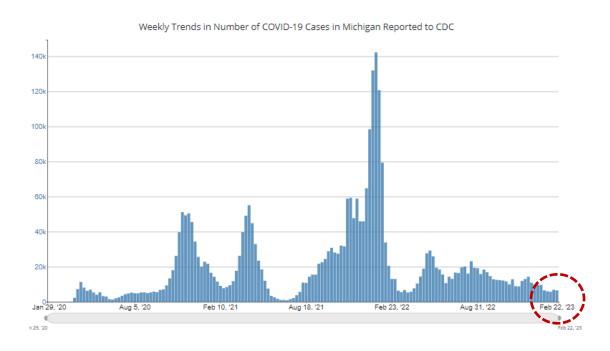
Please note that with updated CDC Community Levels, metrics and/or metric thresholds/goals may change.

Weekly Case Trends in the USA and Michigan

USA

Michigan





Weekly case counts in the US and Michigan remain lower than previous surges and are stable.

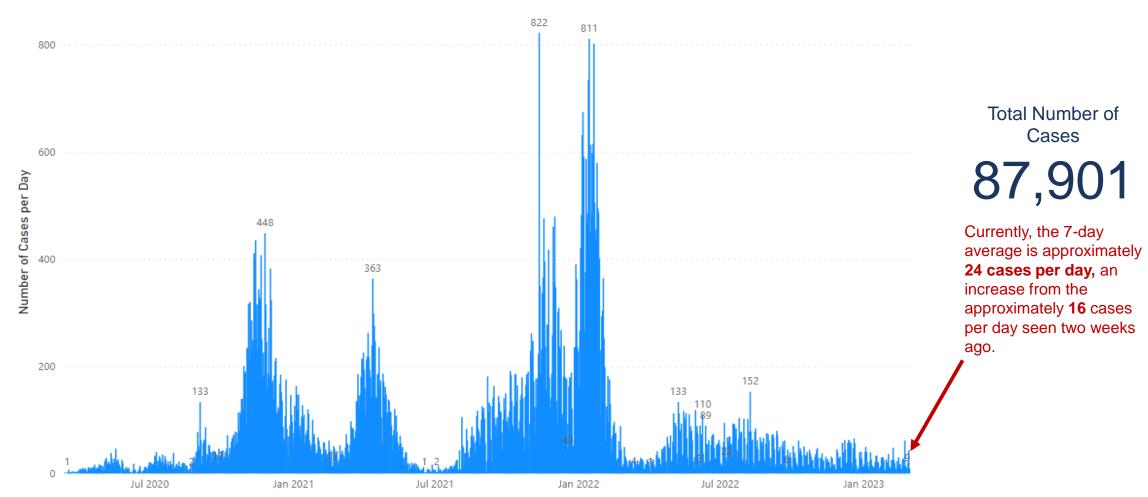
Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in an artificially lower number of cases. **Source:** https://covid.cdc.gov/covid-data-tracker/#trends_dailycases

Data through February 22, 2023

Case Trends in Ottawa County

COVID-19 Cases by Day, Ottawa County, March 15, 2020 – March 1, 2023

Epidemiological Curve



Notes: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in an artificially lower number of cases. Additionally, On November 12, 2021, MDHHS updated their database resulting in a backlog of cases being reported in one day.

Variants

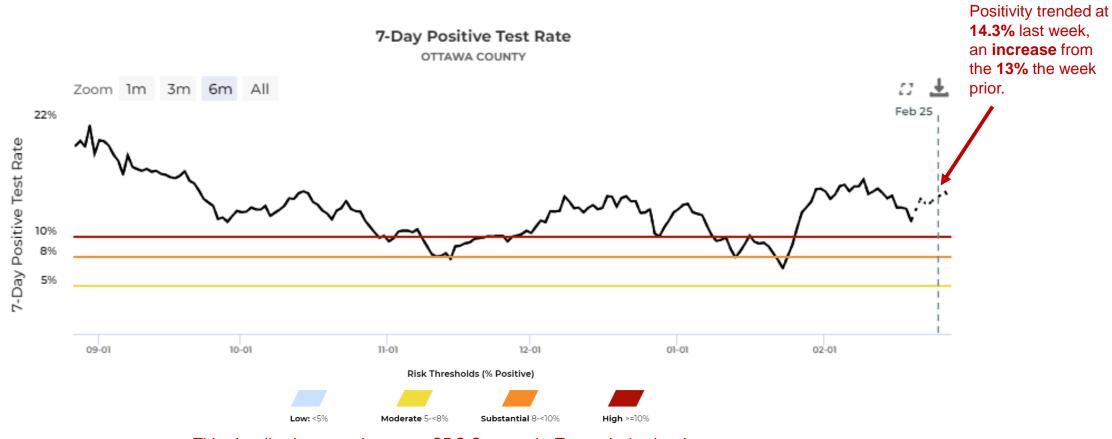
Source: Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Children

Science Roundup

Test Positivity in Ottawa County

COVID-19 Cases by Day, Ottawa County, April 1, 2022 – February 25, 2023



Variants

This visualization may change as CDC Community Transmission levels, metrics and/or metric thresholds/goals change.

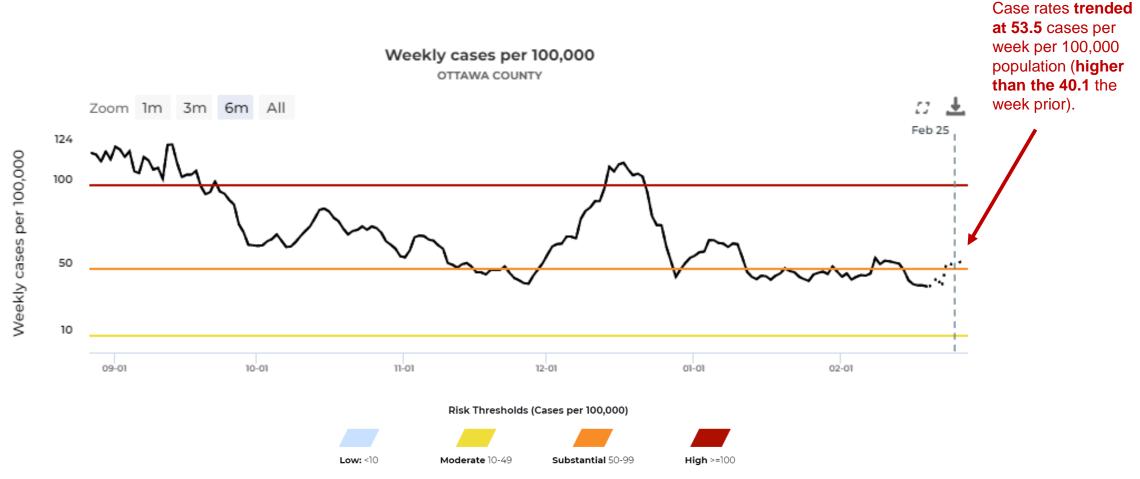
Note: Testing data and can be found at the following sources: Testing Results | Ottawa County Covid-19 Case Summary Data (arcgis.com) & MI Safe Start Map. Use of at-home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in an artificially lower number of cases.

Source: MI Safe Start Map-Ottawa County

Science Roundup

Case Rates in Ottawa County – All Ages

COVID-19 Cases by Day, Ottawa County, April 1, 2022 - February 25, 2023



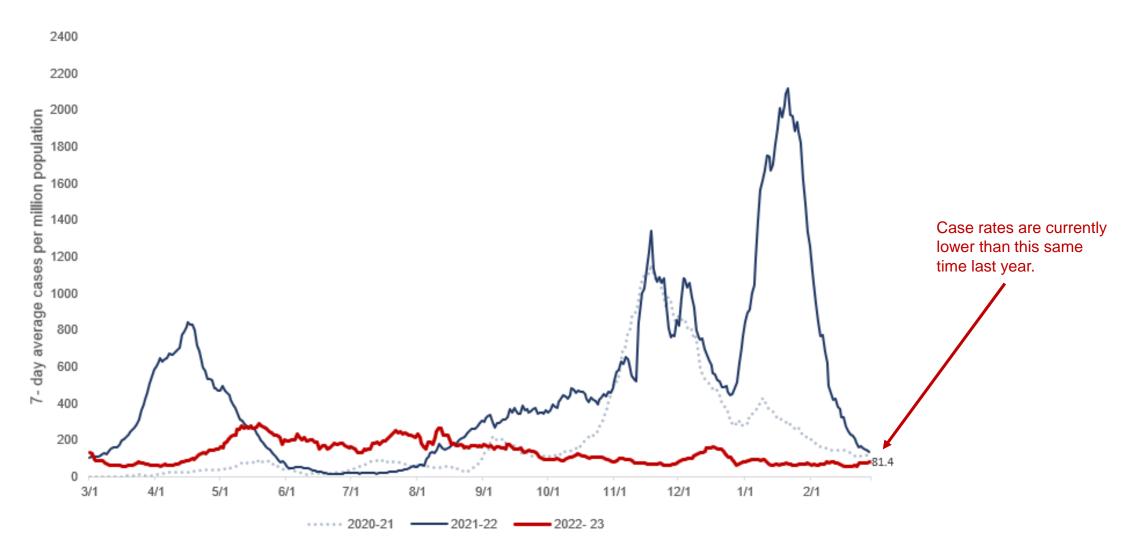
This visualization may change as CDC Community Transmission levels, metrics and/or metric thresholds/goals change.

Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially lower rates.

Source: MI Safe Start Map-Ottawa County

Science Roundup

Ottawa County Trends – Comparison of Case Rates by Year

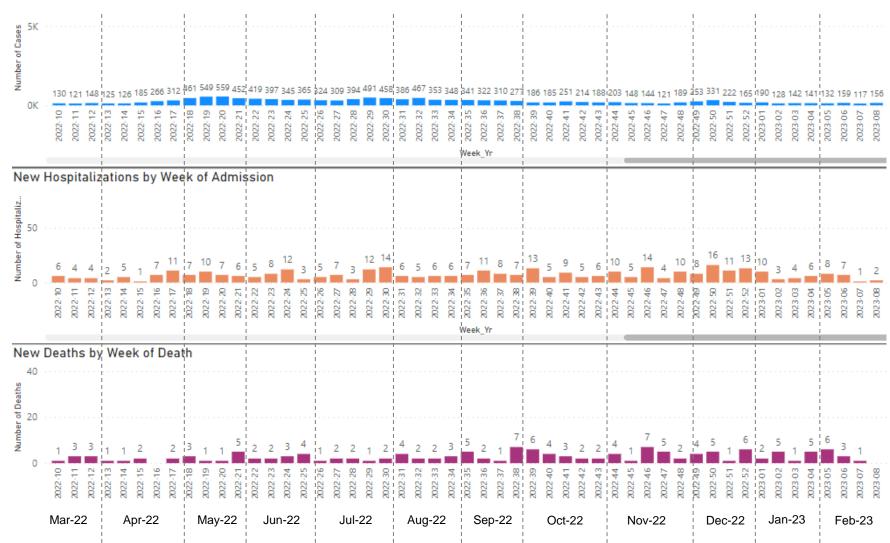


Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially lower case rates. **Source:** Internal Data

Data through March 1, 2023

Ottawa County - Cases, Hospitalizations, & Deaths by Week, All Ages





The weekly number of cases increased 33% from week 7 to week 8.

Weekly COVID-19 deaths remain low. The current weekly average number of deaths over the last 4 weeks is 3 deaths per week.

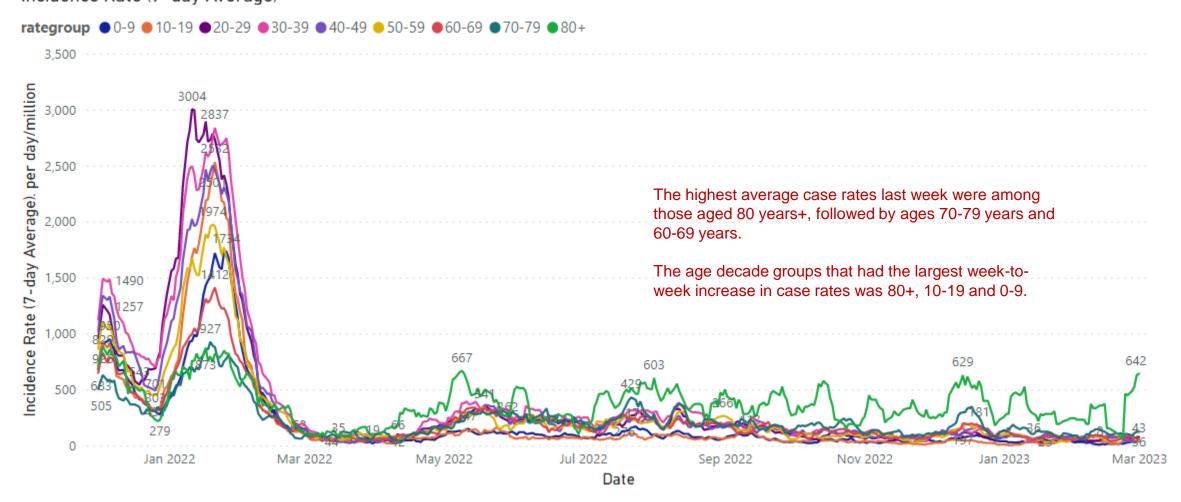
Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially lower number of cases. **Source:** Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Data as of March 1, 2023

data do not include Urgent Care visits, Emergency Department visits, or multiple hospitalizations for a single case.

Ottawa County Case Rate Trends by Age Decade

COVID-19 Case Rates by Age, December 2021 – March 1, 2023 Incidence Rate (7-day Average)



Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially lower rates.

Source: Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Data as of March 1, 2023

Science

Roundup

Variants

Ottawa County Case Rate Trends by Age Decade

Daily new confirmed and probable cases per day per million by age group (daily average per week) Week 8 (February 19, 2023 – February 25, 2023)

Age Decade (Years)	Average Daily Cases	Average Daily Case Rate	One Week % Rate Change
0-9	1.3	35.0	126%
10-19	2.1	48.3	201%
20-29	3.0	66.3	-13%
30-39	1.6	43.8	-48%
40-49	1.4	43.1	-41%
50-59	2.9	82.0	100%
60-69	2.9	87.8	82%
70-79	2.0	96.9	0%
80+	5.1	461.7	227%

Age groups with highest average case rates last week:

- 80+
- 70-79
- 60-69

Age groups with largest week-overweek increase in case rates:

- 80+
- 10-19
- 0-9

Notes: Average daily cases is calculated by summing the weekly total number of cases and dividing by seven. Cases counted in weeks of interest reflect referral date. Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially lower rates.

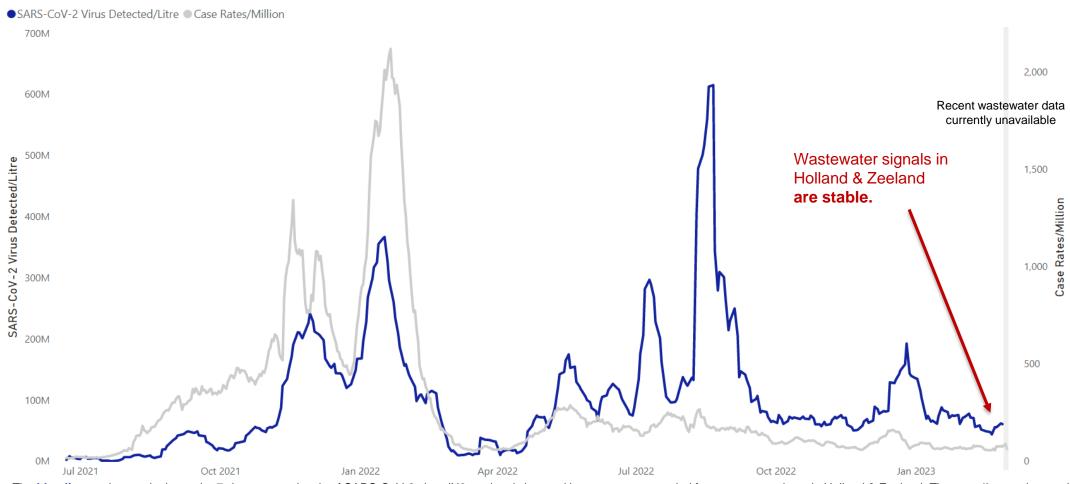
Variants

Source: Michigan Department of Health and Human Services, Michigan Disease Surveillance System; CDC Wonder 2020 population

Data as of March 1, 2023

Holland-Zeeland Wastewater Surveillance

SARS-CoV-2 Virus Detected/Litre by Sample Date With COVID-19 Case Rates/Million by Referral Date (7-Day Averages)



Data Interpretation: The blue line on the graph shows the 7-day average levels of SARS-CoV-2 virus (N2 markers) detected in wastewater sampled from treatment plants in Holland & Zeeland. The gray line on the graph represents the 7-day average COVID-19 case rates/million for all of Ottawa County by referral date.

Notes: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially deflated case rates. Display of wastewater data may change as analytical methods are refined. A data point from Zeeland collected June 23, 2022, was removed from data analysis as an extreme outlier.

Variants

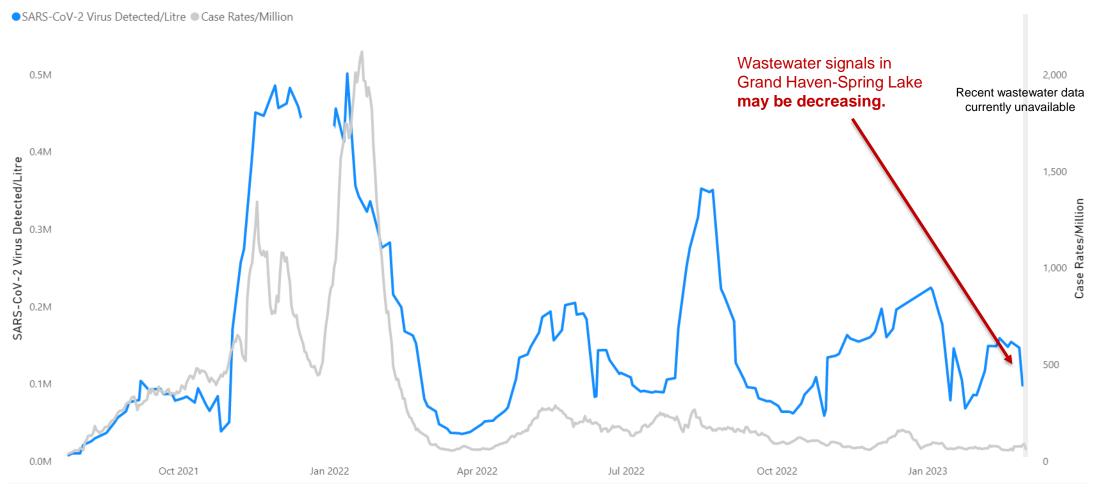
Source: Hope College Global Water Research Institute as part of the MDHHS SEWER-Network, Aaron Best, Ph.D. (best@hope.edu)

Additional Information: Michigan COVID-19 Wastewater Surveillance Pilot Project (arcgis.com), Coronavirus - Sentinel Wastewater Epidemiology Evaluation Project (SWEEP) (michigan.gov)

Data through February 27, 2023

Grand Haven-Spring Lake Wastewater Surveillance

SARS-CoV-2 Virus Detected/Litre by Sample Date With COVID-19 Case Rates/Million by Referral Date (7-Day Averages)



Data Interpretation: The **blue line** on the graph shows the 7-day average levels of SARS-CoV-2 virus (N2 markers) detected in wastewater sampled from the treatment plant in Grand Haven-Spring Lake. The **gray line** on the graph represents the 7-day average COVID-19 case rates/million for all of Ottawa County by referral date.

Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially deflated case rates. Display of wastewater data may change as analytical methods are refined. **Source:** Grand Valley State University Annis Water Resources Institute as part of the MDHHS SEWER-Network, Richard Rediske, Ph.D. (redisker@gvsu.edu)

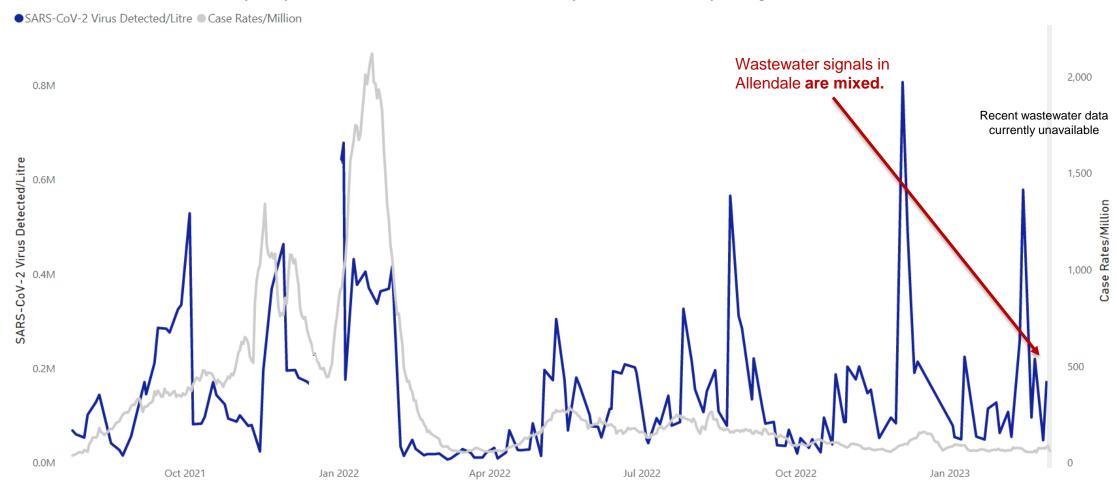
Additional Information: Michigan COVID-19 Wastewater Surveillance Pilot Project (arcgis.com), Coronavirus - Sentinel Wastewater Epidemiology Evaluation Project (SWEEP) (michigan.gov)

Data through February 28, 2023

Risk Levels Other Media Science Roundup

Allendale Wastewater Surveillance

SARS-CoV-2 Virus Detected/Litre by Sample Date With COVID-19 Case Rates/Million by Referral Date (7-Day Averages)



Data Interpretation: The blue line on the graph shows the 7-day average levels of SARS-CoV-2 virus (N2 markers) detected in wastewater sampled from the treatment plant in Allendale. The gray line on the graph represents the 7day average COVID-19 case rates/million for all of Ottawa County by referral date.

Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially deflated case rates. Display of wastewater data may change as analytical methods are refined. Source: Grand Valley State University Annis Water Resources Institute as part of the MDHHS SEWER-Network, Richard Rediske, Ph.D. (redisker@gvsu.edu)

Additional Information: Michigan COVID-19 Wastewater Surveillance Pilot Project (arcgis.com), Coronavirus - Sentinel Wastewater Epidemiology Evaluation Project (SWEEP) (michigan.gov)

Data through February 28, 2023

Science Media Roundup

Ottawa County Weekly Case Counts and % Change, by Age

	Adults (18+)		Children (0-17 years)		Total	
Week Ending	Number	% Change from Previous Week	Number	% Change from Previous Week	Number	% Change from Previous Week
17-Dec-22	289	27%	42	62%	331	31%
24-Dec-22	198	-31%	24	-43%	222	-33%
31-Dec-22	152	-23%	13	-46%	165	-26%
7-Jan-23	177	16%	13	0%	190	15%
14-Jan-23	113	-36%	15	15%	128	-33%
21-Jan-23	130	15%	12	-20%	142	11%
28-Jan-23	121	-7%	20	67%	141	-1%
4-Feb-23	116	-4%	16	-20%	132	-6%
11-Feb-23	151	30%	8	-50%	159	20%
18-Feb-23	111	-26%	6	-25%	117	-26%
25-Feb-23	141	27%	15	(150%)	156	33%

Weekly case counts among children increased 150% last week, and cases in adults increased 27%.

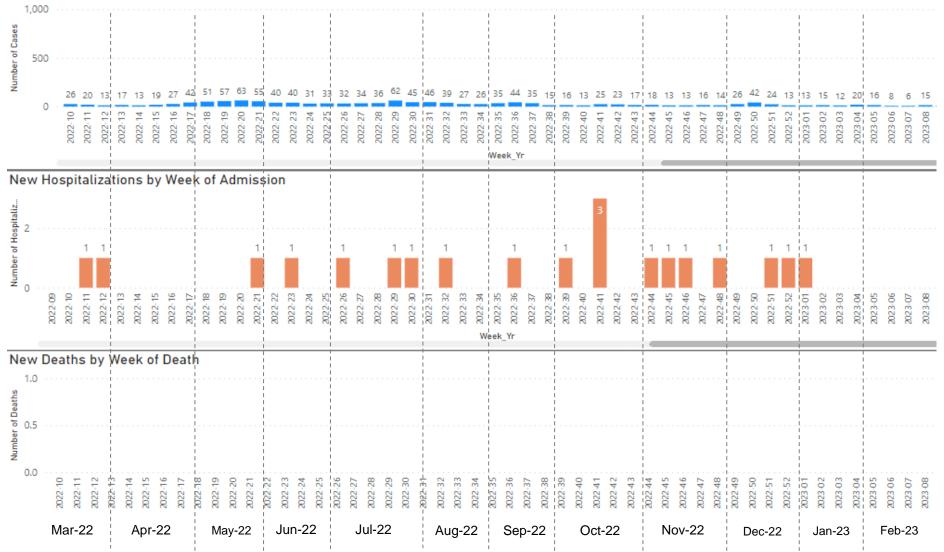
Adults Children

Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in an artificially lower number of cases. **Source:** Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Science Roundup

Ottawa County – Cases, Hospitalizations, & Deaths by Week Among Children (0-17 years)





The weekly number of cases among children increased **150%** from week 7 to week 8.

There have not been any COVID-19 associated deaths in children since the first one occurred in early January of 2022 (not pictured).

Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially deflated case counts.

Source: Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Data as of March 1, 2023

Variants

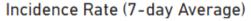
Other

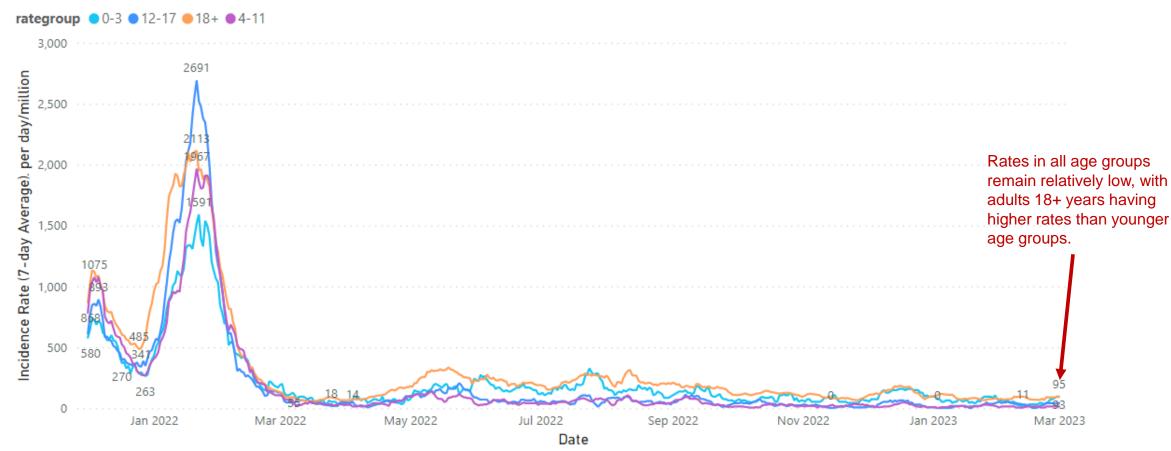
Hospitalization data include all Ottawa ever been hospitalized for COVID-19 or

hospitalizations for a single case.

Ottawa County - Case Rate Trends by Age

COVID-19 Case Rates by Age, includes School-Aged, December 2021 – March 1, 2023

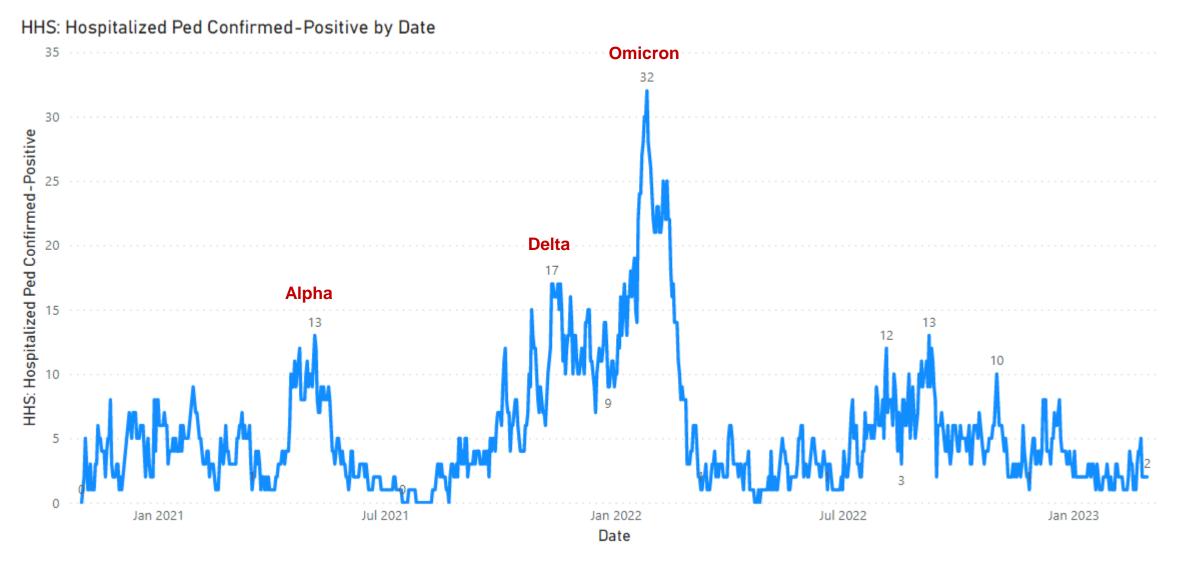




Note: Use of at home tests since late 2021 likely reduces the number of positive tests reported to Public Health, resulting in artificially deflated case rates. **Source:** Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Data as of March 1, 2023

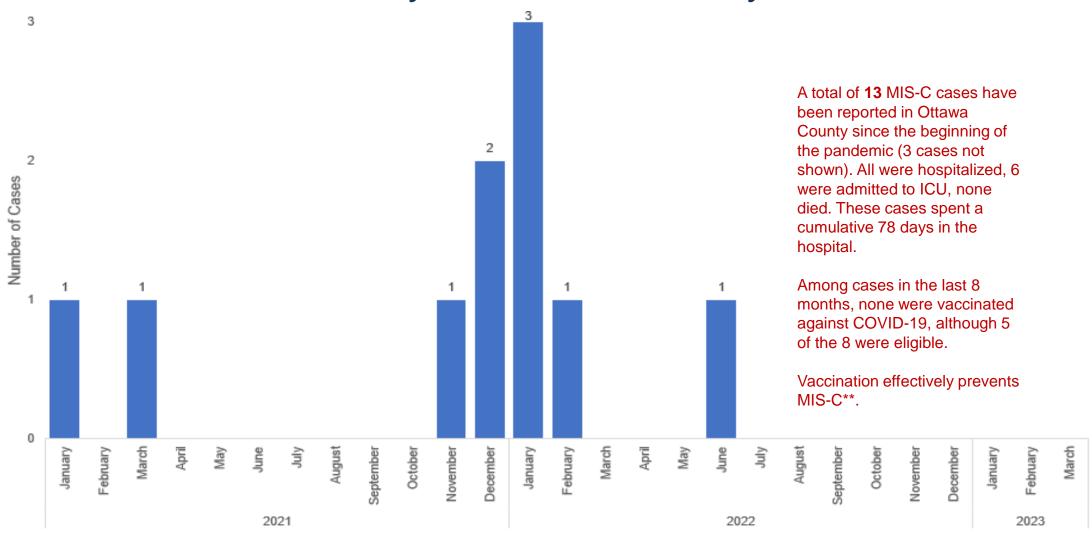
Daily Hospital Pediatric Census – West Michigan



Note: Data above includes persons younger than 18 years of age with confirmed COVID-19 hospitalized at West Michigan hospitals. Patients may be listed in more than one day. Data may change as information is updated. Includes patients that reside in counties across the region, including Ottawa County.

Data through March 1, 2023

Ottawa County MIS-C* Cases by Month



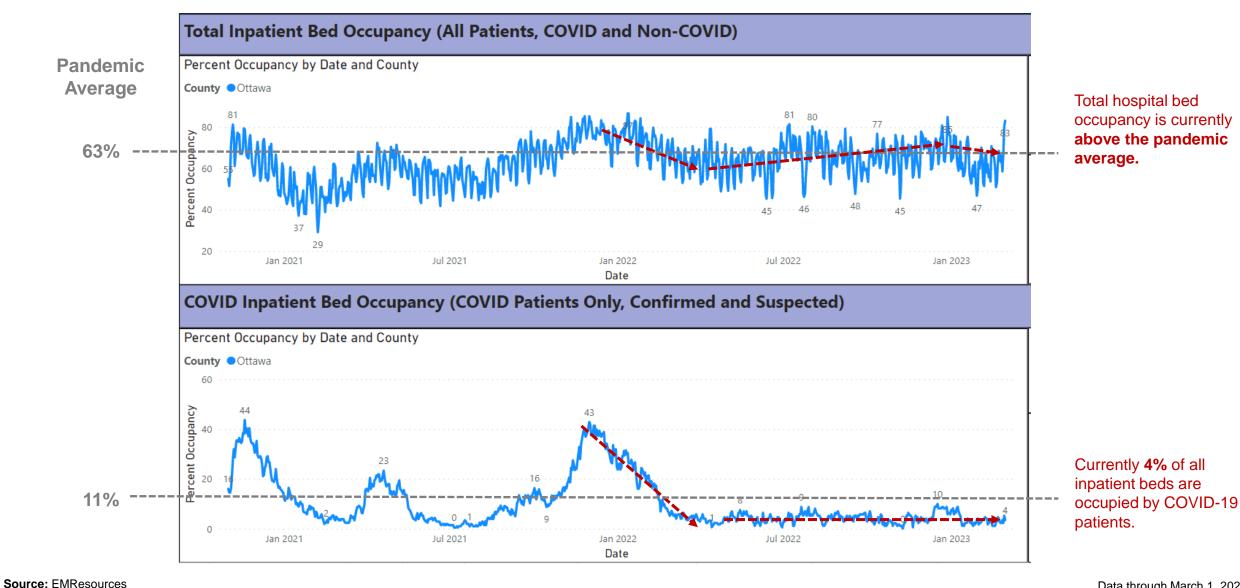
Notes: Includes confirmed and probable cases.

**Sources: MMWR & The Lancet

Data through March 1, 2023

^{*}MIS-C is a rare but serious condition affecting children, associated with recent COVID-19 infection. For more details on MIS-C please visit: https://www.cdc.gov/mis/index.html

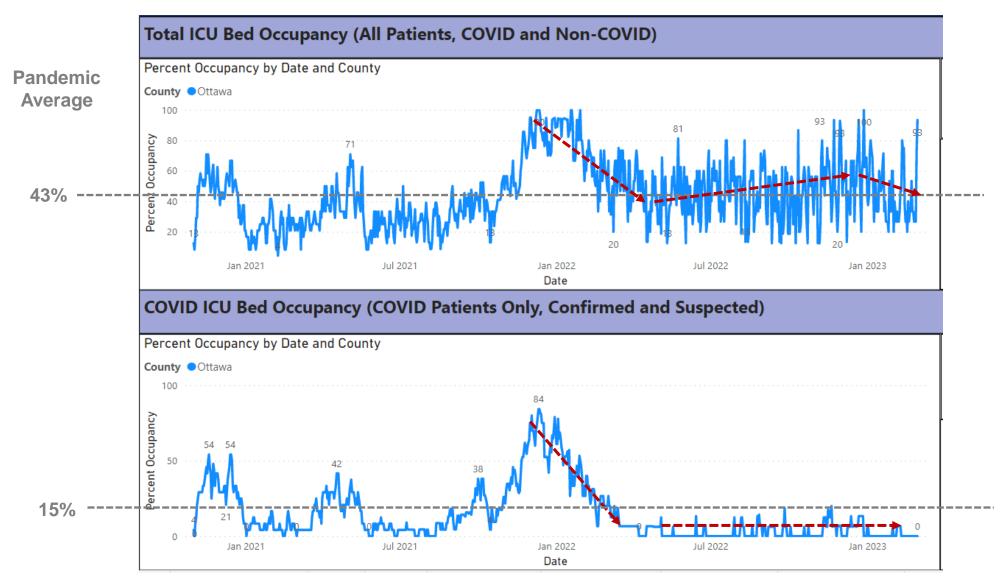
Ottawa County Hospital Capacity – All Beds



Data through March 1, 2023

Science Other Media Roundup

Ottawa County Hospital Capacity – ICU Beds



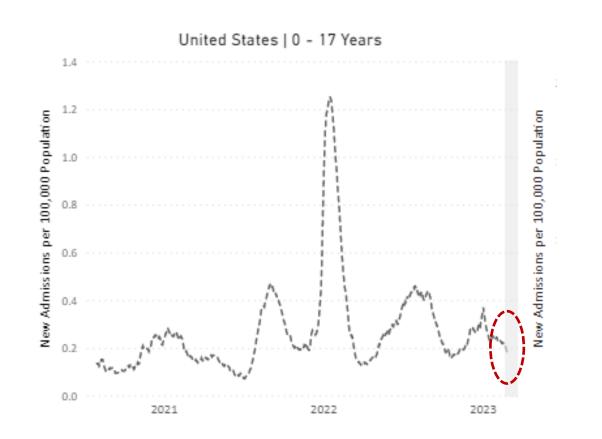
Total ICU bed occupancy varies considerably by day. Lately, ICU bed occupancy is above the pandemic average

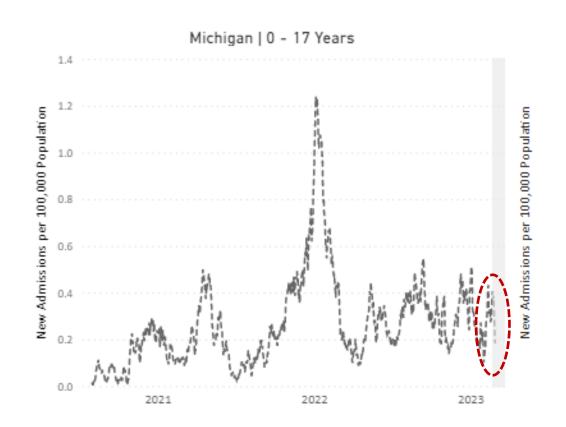
The proportion of ICU beds occupied by COVID-19 patients is below the pandemic average. Currently, 0% of ICU beds occupied by COVID-19 patients.

Source: EMResources Data through March 1, 2023

Variants

Pediatric Hospitalization Rates – USA, Michigan





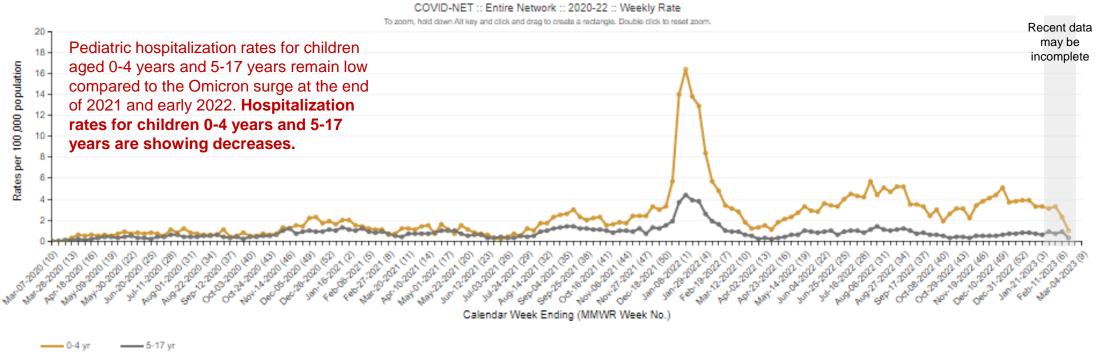
Pediatric COVID-19 hospitalization rates across the US are relatively low, while rates in Michigan are relatively low but showing recent fluctuation.

Variants

Source: https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions

Accessed March 2, 2023

Pediatric Hospitalization Rates by Age Group – USA



The Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET) hospitalization data are preliminary and subject to change as more data become available. In particular, case counts and rates for recent hospital admissions are subject to lag. Lag for COVID-NET case identification and reporting might increase around holidays or during periods of increased hospital utilization. As data are received each week, prior case counts and rates are updated accordingly. COVID-NET conducts population-based surveillance for laboratory-confirmed COVID-19-associated hospitalizations in children (less than 18 years of age) and adults. COVID-NET covers nearly 100 counties in the 10 Emerging Infections Program (EIP) states (CA, CO, CT, GA, MD, MN, NM, NY, OR, TN) and four Influenza Hospitalization Surveillance Project (IHSP) states (IA [March 2020-May 2022], MI, OH, and UT). Incidence rates (per 100,000 population) are calculated using the National Center for Health Statistics' (NCHS) vintage 2020 bridged-race postcensal population estimates for the counties included in the surveillance catchment area. The rates provided are likely to be underestimated as COVID-19 hospitalizations might be missed due to test availability and provider or facility testing practices. The NCHS bridged-race data used for the denominator for race data provides population data for children ages 0–1 year. To calculate rates of hospitalization among children ages <6 months and 6 months to <12 months, the population for children ages 0–1 year is halved.

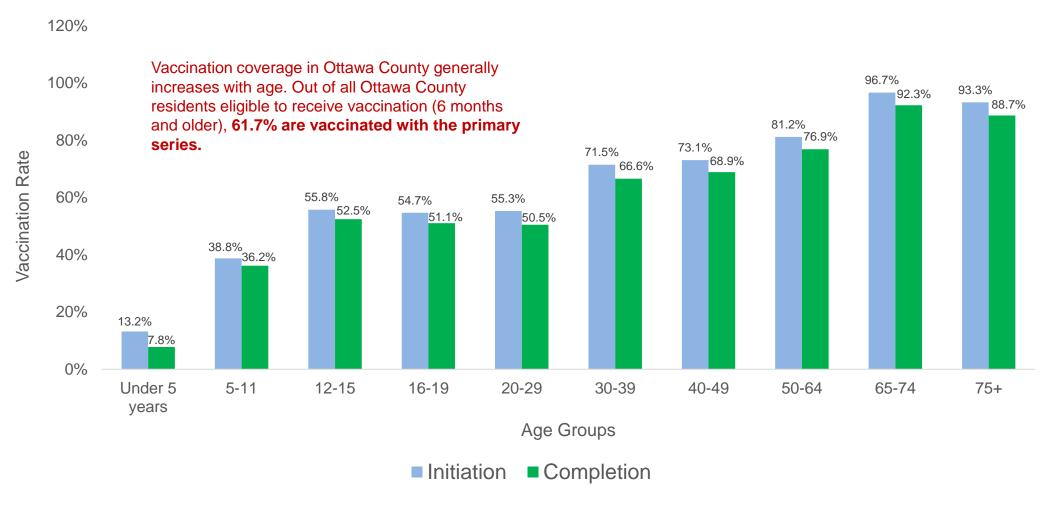
Variants

Starting MMWR week 22 of 2022, IA data are removed from weekly rate calculations.

Source: https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalization-network

Accessed March 2, 2023

Vaccination Coverage by Age (Primary Series Only)



Notes: Completion is the percentage of people receiving at least 2 doses of Pfizer or Moderna or 1 dose of J&J. NovaVax doses are not included here.

Source: https://www.michigan.gov/coronavirus/resources/covid-19-vaccine/covid-19-dashboard

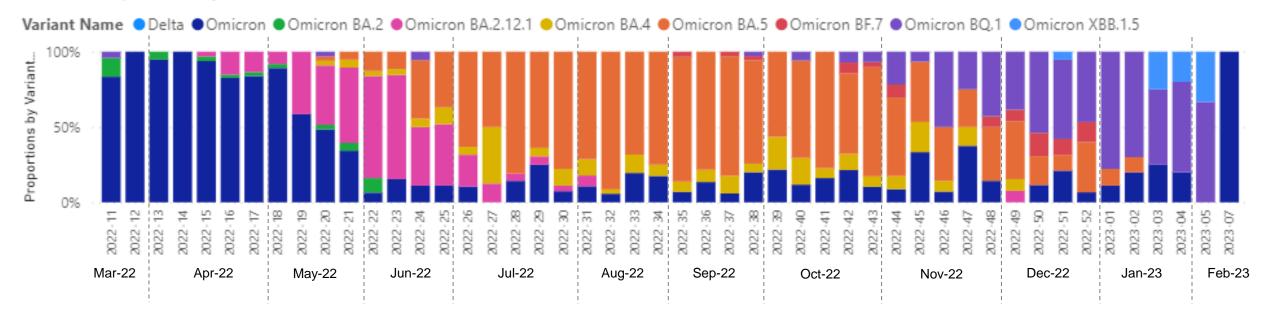
Data through March 2, 2023

Science

Roundup

Variants – Clinical Samples from Ottawa County Residents

Variant Proportions by Week



By the end of July 2021 through early December 2021, all clinical samples* tested were identified as the **Delta** variant (data not displayed here).

In mid-December 2021, the first **Omicron** positive sample was collected in an Ottawa County resident (data not displayed here), and **Omicron** continues to be detected into 2023, with more recent additions of the **Omicron subvariants** such as BQ.1 and XBB.1.5. Additional **Omicron subvariants** may be detected in clinical samples in the months ahead.

Variants

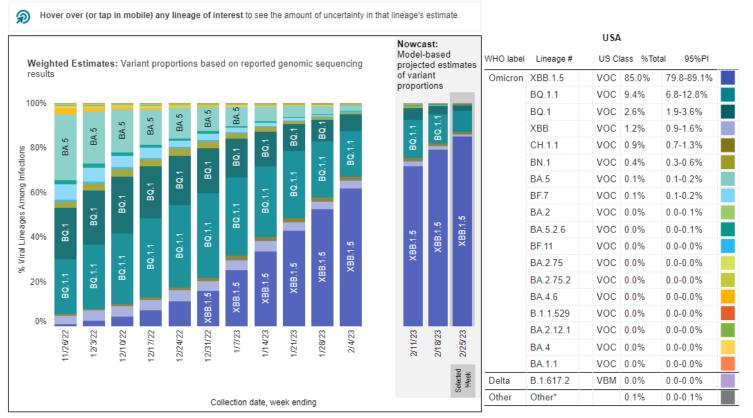
Science Roundup

^{*} Swabs from Ottawa County residents that tested positive for COVID-19 by PCR; only a small proportion of all COVID-19 positive tests are tested for variants. **Source:** Michigan Department of Health and Human Services, Michigan Disease Surveillance System

Variants – Clinical Samples from Across the USA

Weighted and Nowcast Estimates in United States for Weeks of 11/20/2022 – 2/25/2023

Nowcast Estimates in United States for 2/19/2023 – 2/25/2023



The **Omicron** variant and it's subvariants are estimated to account for more than 99% of all clinical samples collected in the United States the week ending February 25, 2023.

The BA.5 subvariant has been supplanted by other Omicron subvariants such as XBB.1.5, BQ.1.1, BQ.1, and others.

Source: CDC: https://covid.cdc.gov/covid-data-tracker/#variant-proportions

Accessed March 1, 2023

^{*} Enumerated lineages are US VOC and lineages circulating above 1% nationally in at least one week period. "Other" represents the aggregation of lineages which are circulating <1% nationally during all weeks displayed.

[#] BA.1, BA.3 and their sublineages (except BA.1.1 and its sublineages) are aggregated with B.1.1.529. Except BA.2.12.1, BA.2.75, XBB and their sublineages, BA.2 sublineages are aggregated with BA.2. Except BA.2.75. CH.1.1 and BN.1, BA.2.75 sublineages are aggregated with BA.2.75. Except BA.4.6, sublineages of BA.4 are aggregated to BA.4. Except BF.7, BF.11, BA.5.2.6, BQ.1 and BQ.1.1, sublineages of BA.5 are aggregated to BA.5. Except XBB.1.5, sublineages of XBB are aggregated to XBB. For all the other lineages listed, their sublineages are aggregated to the listed parental lineages respectively. Previously, CH.1.1 was aggregated to BA.2.75. Lineages BA.2.75.2, XBB, XBB.1.5, BN.1, BA.4.6, BF.7, BF.11, BA.5.2.6 and BQ.1.1 contain the spike substitution R346T.

COVID-19 Community Levels

TABLE 1. COVID-19 Community Levels, Indicators, and Thresholds

New COVID-19 Cases Per 100,000 people in the past 7 days	Indicators	Low	Medium	High
Fewer than 200	New COVID-19 admissions per 100,000 population (7-day total)	<10.0	10.0-19.9	≥20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	<10.0%	10.0-14.9%	≥15.0%
200 or more	New COVID-19 admissions per 100,000 population (7-day total)	NA	<10.0	≥10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	NA	<10.0%	≥10.0%

Please note that the Community Levels indicators for hospital admission and occupancy shown here apply to COVID-19 patients only.

While Ottawa County
COVID-19 admissions and
hospital occupancy have
remained <10% for many
months, reducing infections
and preventing
hospitalizations for/with
COVID-19 is important to
ensure capacity in local
hospitals that may face
substantial occupancy
challenges from RSV,
influenza, and other
conditions.

The COVID-19 community level is determined by the higher of the *new admissions* and *inpatient beds occupied* metrics, based on the current level of *new cases per 100,000 population in the past 7 days*.

Variants

Source: https://www.cdc.gov/coronavirus/2019-ncov/science/community-levels.html

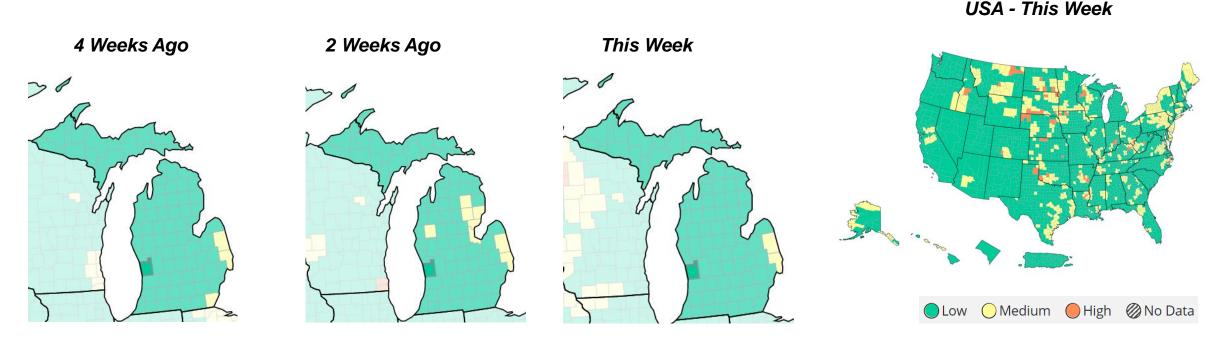
USA & MI

CDC Community Levels – Ottawa County

- Current Community Level in Ottawa LOW
 - Ottawa and Michigan's CDC Community Levels can be viewed on the CDC website and on the MI Safe Start Map.

Current Data:

- New COVID-19 Hospital Admissions (per 100K pop 7-day total) = 2.2
- Percent of staffed inpatient beds in use by patients with COVID-19 (7-day average) = 2.4%



Source: CDC COVID Data Tracker: Community Levels

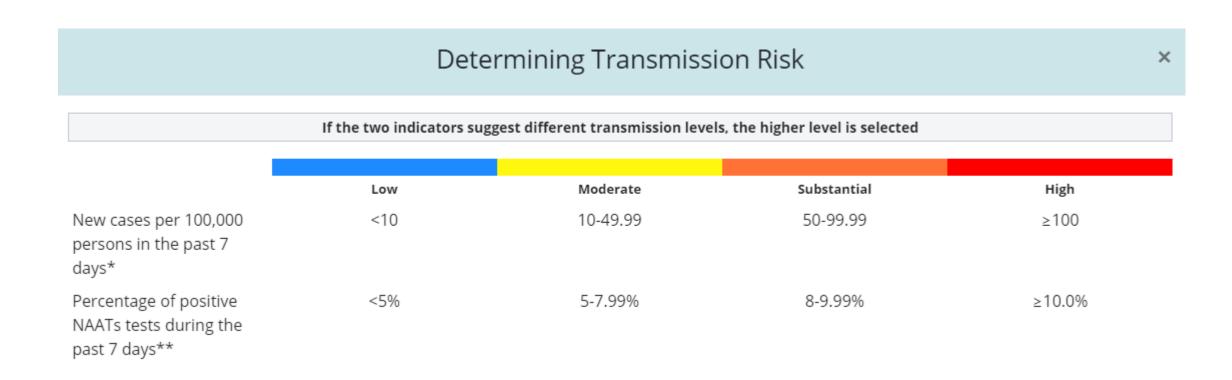
Spread

Data updated by CDC on March 2, 2023. Ottawa Hospitalization data as of February 28, 2023.

> Science Roundup

Vaccinations

COVID-19 Community Transmission Levels



Source: https://covid.cdc.gov/covid-data-tracker/#county-view?list_select_state=all_states&data-type=Risk



CDC Community Transmission Levels – Ottawa County

- Current Community Transmission Level in Ottawa HIGH
 - Ottawa and Michigan's CDC Community Transmission Levels can be viewed on CDC's website and on the MI Safe Start Map.
- **Current Data:**
 - Case Rate (per 100k pop 7-day total) = **53.11**
 - Percent Test Positivity (last 7 days) = **13.7%**

This Week 4 Weeks Ago 2 Weeks Ago

Substantial Moderate Low No Data

Variants

Source: CDC COVID Data Tracker: Community Transmission

USA & MI

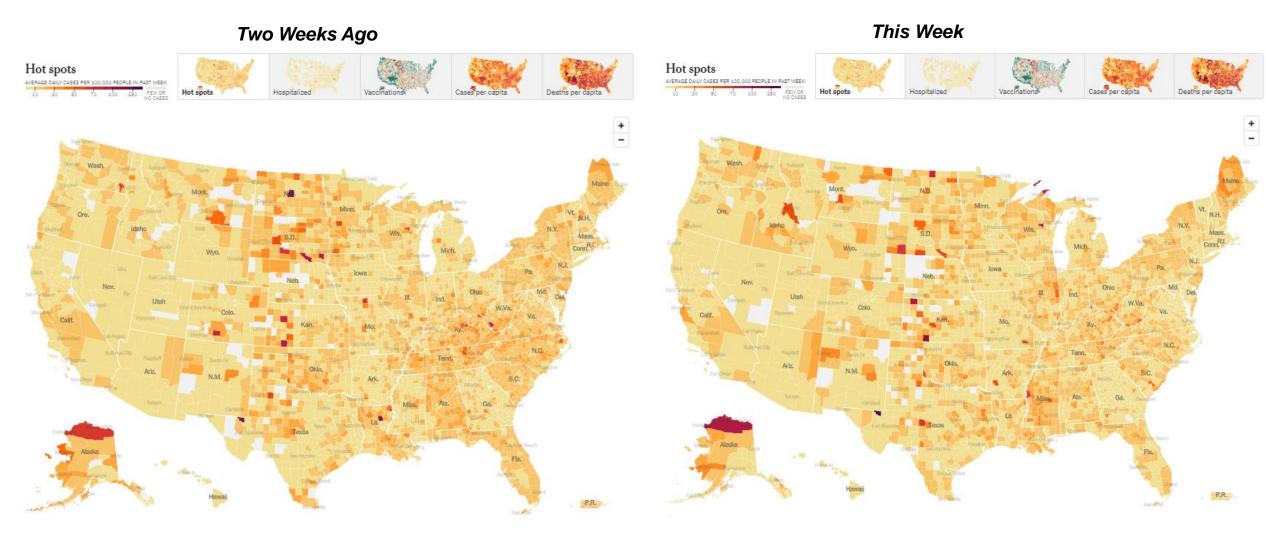
Data updated by CDC on March 2, 2023. Rate data for Ottawa as of March 2, 2023. Positivity data for Ottawa as of February 27, 2023.

Other

Science Roundup

USA - This Week

COVID-19 Case Rates by County Across the US



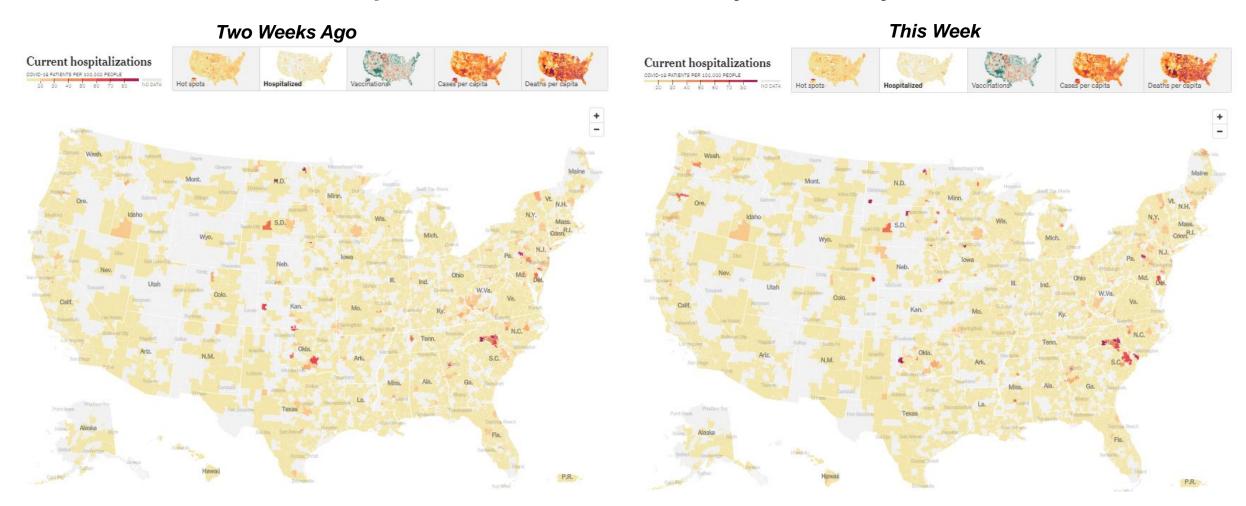
Case rates across the nation appear to be stable, with regional variability.

Variants

Source: https://www.nytimes.com/interactive/2021/us/covid-cases.html

Accessed March 2, 2023

COVID-19 Hospitalization Rates by County Across the US



Hospitalization rates remain relatively low across most of the nation.

Source: https://www.nytimes.com/interactive/2021/us/covid-cases.html

COVID-19 News Headlines

98% of Michigan counties at low COVID level this week, CDC says

https://www.mlive.com/public-interest/2023/02/98-of-michigan-counties-atlow-covid-level-this-week-cdc-says.html

US COVID-19 activity declines further

https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html

Michigan outperforms U.S. in addressing COVID racial disparities, report says

https://www.mlive.com/public-interest/2023/02/michigan-outperforms-us-inaddressing-covid-racial-disparities-report-says.html

Pfizer and BioNTech Submit Supplemental Biologics License Application for U.S. FDA Approval of Omicron BA.4/BA.5-Adapted Bivalent COVID-19 Vaccine for Ages 12 Years and Older as Primary Series or Booster

https://www.pfizer.com/news/press-release/press-release-detail/pfizer-andbiontech-submit-supplemental-biologics-license-1

> Science Roundup

Science Roundup

Evaluation of BNT162b2 Covid-19 Vaccine in Children Younger than 5 Years of Age

This phase 1 dose-finding study of children six months to four years of age found that the overall vaccine efficacy against symptomatic COVID-19 was 73.2% from seven days post third dose suggesting a three-dose primary series of BNT162b2 is safe and efficacious for young children.

https://www.nejm.org/doi/pdf/10.1056/NEJMoa2211031

Notes from the Field: Aircraft Wastewater Surveillance for Early Detection of SARS-CoV-2 Variants — John F. Kennedy International Airport, New York City, August–September 2022



A surveillance study of wastewater collected from 80 incoming international flights found that 81% of the samples tested positive for SARS-CoV-2, illustrating the feasibility of aircraft wastewater surveillance as a low-resource complement or alternative to individual testing to monitor SARS-CoV-2.

https://www.cdc.gov/mmwr/volumes/72/wr/pdfs/mm7208a3-H.pdf

Structural brain changes in patients with post-COVID fatigue: a prospective observational study



This prospective observational study found an association between imaging changes of thalamic and basal ganglia, and the persistent fatigue experienced among patients with post-COVID syndrome.

https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(23)00051-2/fulltext

Past SARS-CoV-2 infection protection against reinfection: a systematic review and meta-analysis



This systematic review and meta-analysis of 65 studies from 19 different countries found that protection from past SARS-CoV-2 infection was high against re-infection from all pre-omicron variants, substantially lower against re-infection from omicron, and higher against severe disease for all variants.

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(22)02465-5/fulltext

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