Multisystem Inflammatory Syndrome in Children (MIS-C)

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MDHHS

MIS-C Overview

- **MIS-C is a severe hyperinflammatory condition in children and adolescents associated with current or recent SARS-CoV-2 infection**
- **Characterized by fever, systemic inflammation, and multisystem organ involvement**
- **MIS-C generally occurs 2-6 weeks after SARS-CoV-2 infection, and higher MIS-C incidence closely follows peaks of reported SARS-CoV-2 circulation**
- **MIS-C represents a severe complication of COVID-19 in children, although initial SARS-CoV-2 infection in most persons with MIS-C is mild or asymptomatic**

MIS-C Overview

- **April 2020 - Clinicians in the UK first described severe inflammation in previously healthy children after acute SARS-CoV-2 infection**
  - "Kawasaki disease-like features"
- **Early May 2020 – Cases reported in New York and New York State**
- **May 14, 2020 - the CDC issued a health advisory:**
  - Outlined a MIS-C case definition
  - Asked clinicians to report suspected cases to local and state health departments
  - Established a national reporting platform to systematically collect data on MIS-C cases from health departments
- **May 15, 2020 – MIHAN was issued with CDC health advisory information**

MIS-C Case Definition

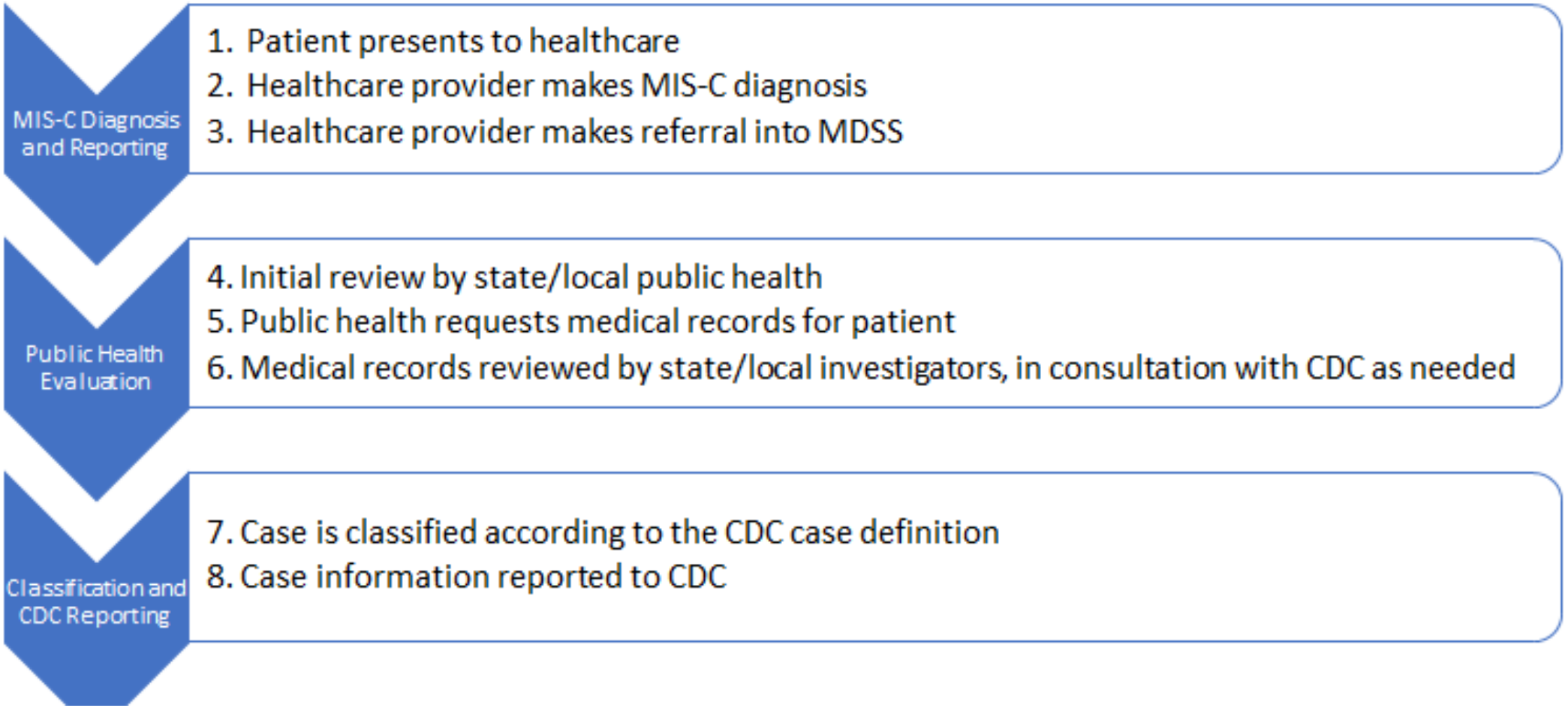
- **An individual aged <21 years presenting with fever*, laboratory evidence of inflammation**, and evidence of clinically severe illness requiring hospitalization, with multisystem (≥2) organ involvement (cardiac, renal, respiratory, hematologic, gastrointestinal, dermatologic or neurological); AND**
- **No alternative plausible diagnoses; AND**
- **Positive for current or recent SARS-CoV-2 infection by RT-PCR, serology, or antigen test; or exposure to a suspected or confirmed COVID-19 case within the 4 weeks prior to the onset of symptoms.**

*Fever ≥38.0°C for ≥24 hours, or report of subjective fever lasting ≥24 hours
**Including, but not limited to, one or more of the following: an elevated C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), fibrinogen, procalcitonin, d-dimer, ferritin, lactic acid dehydrogenase (LDH), or interleukin 6 (IL-6), elevated neutrophils, reduced lymphocytes and low albumin

Additional comments:

- **Some individuals may fulfill full or partial criteria for Kawasaki disease but should be reported if they meet the case definition for MIS-C.**
- **Consider MIS-C in any pediatric death with evidence of SARS-CoV-2 infection.**

Process for Surveillance of Multisystem Inflammatory Syndrome in Children (MIS-C)

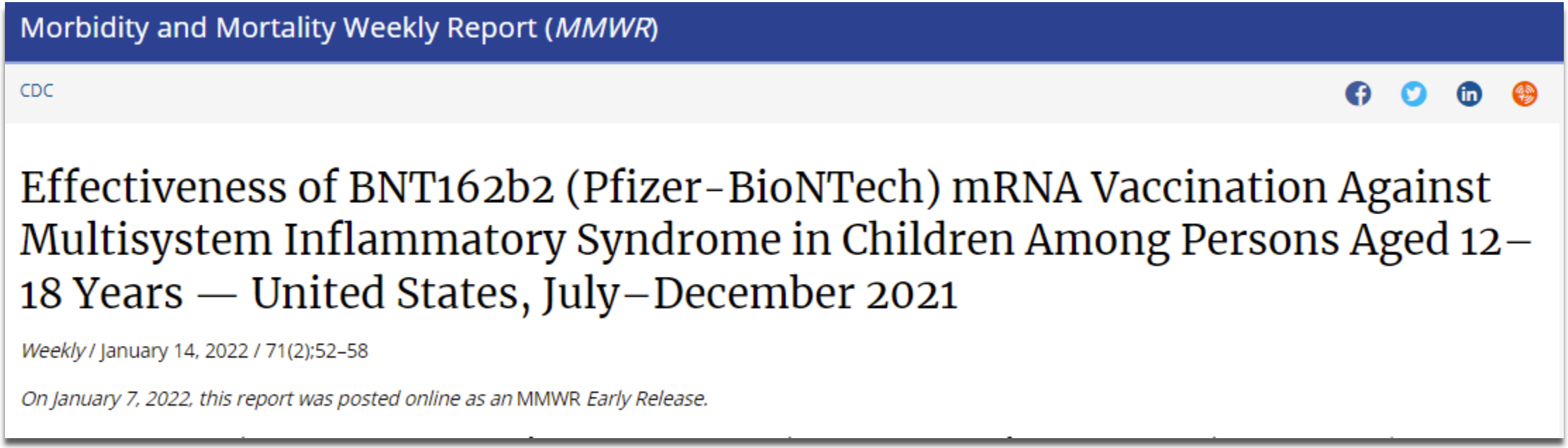


MIS-C Surveillance Activities

- All COVID-19 associated pediatric deaths are evaluated for MIS-C criteria
- Per CDC request, all eligible MIS-C cases are being assessed for vaccination status
- Case referrals of Kawasaki Disease and pediatric COVID-19 are being evaluated monthly for MIS-C criteria
- Bi-weekly syndromic surveillance reports reviewed for suspect MIS-C and Kawasaki visits

- **Class 1 (n=203), "typical" MIS-C**
  - 98% serology positive, 36% PCR positive
  - 100% cardiovascular and 98% gastrointestinal manifestations
  - 84% ICU admission
- **Class 2 (n=169), acute COVID-19/MIS-C Combo**
  - 16% serology positive, 100% PCR positive
  - More severe respiratory involvement (37% pneumonia, 10% ARDS)
  - 62% ICU admission
- **Class 3 (n=198), milder illness**
  - 97% serology positive, 36% PCR positive
  - Younger, median age 6 years
  - Higher frequency of rash (63%), mucocutaneous lesions (45%)
  - 44% ICU admission

Godfred-Cato S, Bryant B, Leung J, et al. COVID-19–Associated Multisystem Inflammatory Syndrome in Children — United States, March–July 2020. MMWR Morb Mortal Wkly Rep 2020;69:1074–1080. DOI: http://dx.doi.org/10.15585/mmwr.mm6932e2



- Vaccine effectiveness of two doses of the Pfizer-BioNTech vaccine against MIS-C was **91% (95% CI = 78-97%)**
- 97/102 (95%) of hospitalized children with MIS-C were unvaccinated
- None of the five fully vaccinated MIS-C patients required respiratory or cardiovascular life support compared to 39% of unvaccinated MIS-C patients

Zambrano LD, Newhams MM, Olson SM, et al. Effectiveness of BNT162b2 (Pfizer-BioNTech) mRNA Vaccination Against Multisystem Inflammatory Syndrome in Children Among Persons Aged 12–18 Years — United States, July–December 2021. MMWR Morb Mortal Wkly Rep 2022;71:52–58. DOI: http://dx.doi.org/10.15585/mmwr.mm7102e1

Clinical Infectious Diseases

MAJOR ARTICLE

IDSA Infectious Diseases Society of America

hivma hiv medicine association

OXFORD

Multisystem Inflammatory Syndrome in Children—United States, February 2020–July 2021

Allison D. Miller,[1] Laura D. Zambrano,[1] Anna R. Yousaf,[1] Joseph Y. Abrams,[1] Lu Meng,[1] Michael J. Wu,[1] Michael Melgar,[1] Matthew E. Oster,[1] Shana E. Godfred Cato,[1] Ermias D. Belay,[1] and Angela P. Campbell[1]; for the MIS-C Surveillance Authorship Group[a]

[1]CDC COVID-19 Response Team, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

- 4,470 cases of MIS-C reported to CDC's national surveillance system with illness onset from February 19, 2020 through July 31, 2021
- Frequency of several cardiovascular complications including cardiac dysfunctions, myocarditis, and shock/vasopressor receipt declined over time
- Clinical outcomes, including length of hospitalization, receipt of mechanical ventilations, ECMO, and death–improved across the first three pandemic waves of MIS-C

Allison D Miller, Laura D Zambrano, Anna R Yousaf, Joseph Y Abrams, Lu Meng, Michael J Wu, Michael Melgar, Matthew E Oster, Shana E Godfred Cato, Ermias D Belay, Angela P Campbell, MIS-C Surveillance Authorship Group, Multisystem Inflammatory Syndrome in Children—United States, February 2020–July 2021, *Clinical Infectious Diseases*, 2021;, ciab1007, https://doi.org/10.1093/cid/ciab1007

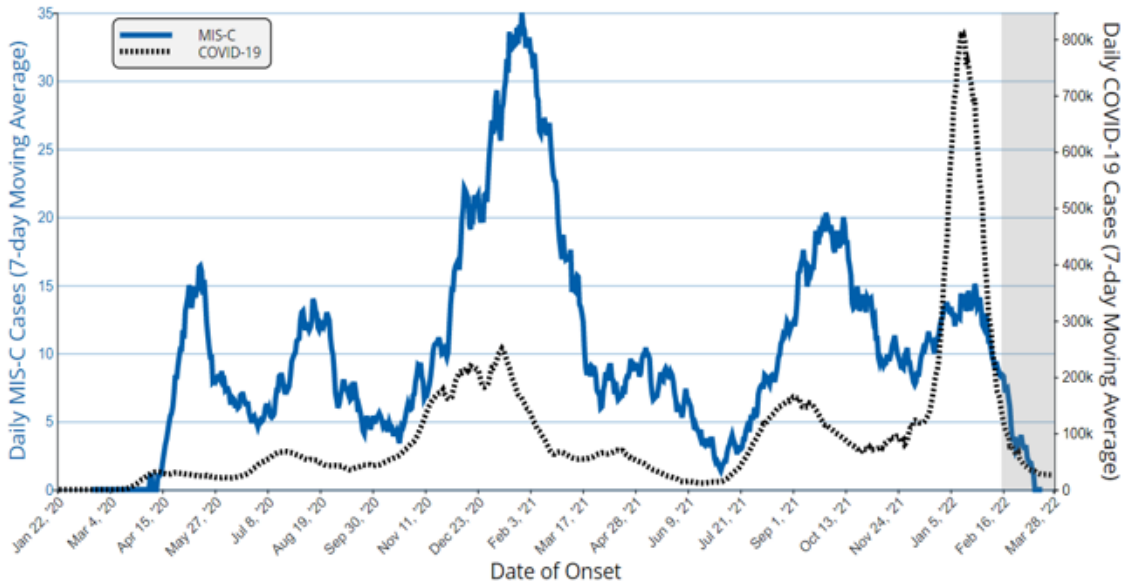
Multisystem Inflammatory Syndrome in Children (MIS-C)

Incidence of MIS-C is approximately 1 case in ~3,200 SARS-CoV-2 infections

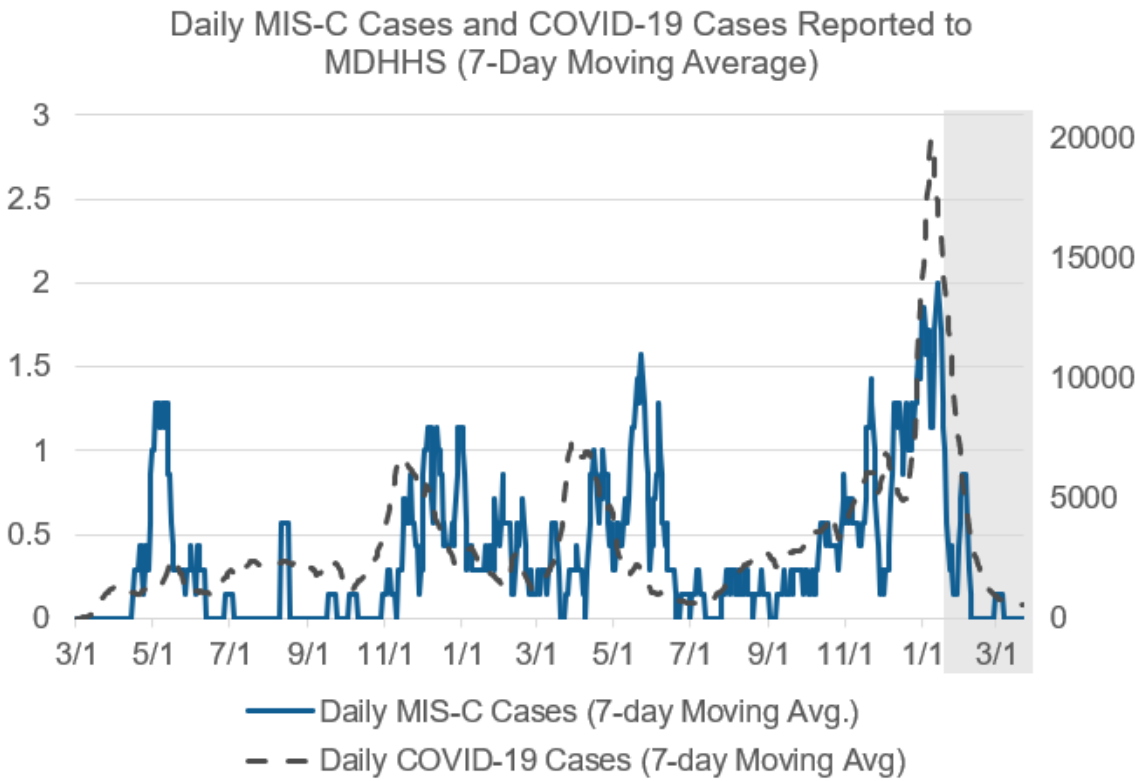
- Higher community transmissions is followed by higher incidence of MIS-C cases nationally

U.S. National Data

Daily MIS-C Cases and COVID-19 Cases Reported to CDC (7-Day Moving Average)



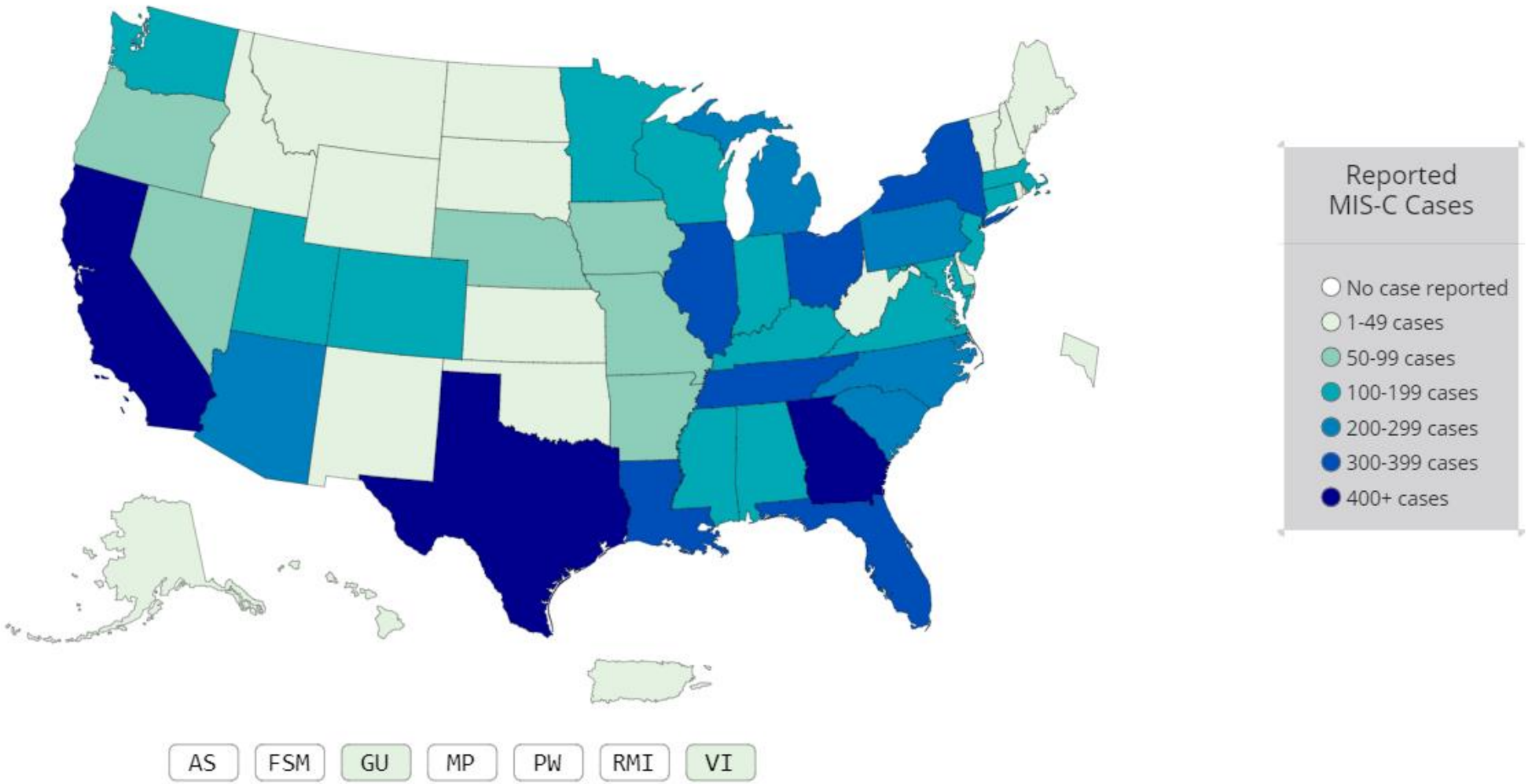
MI State Data



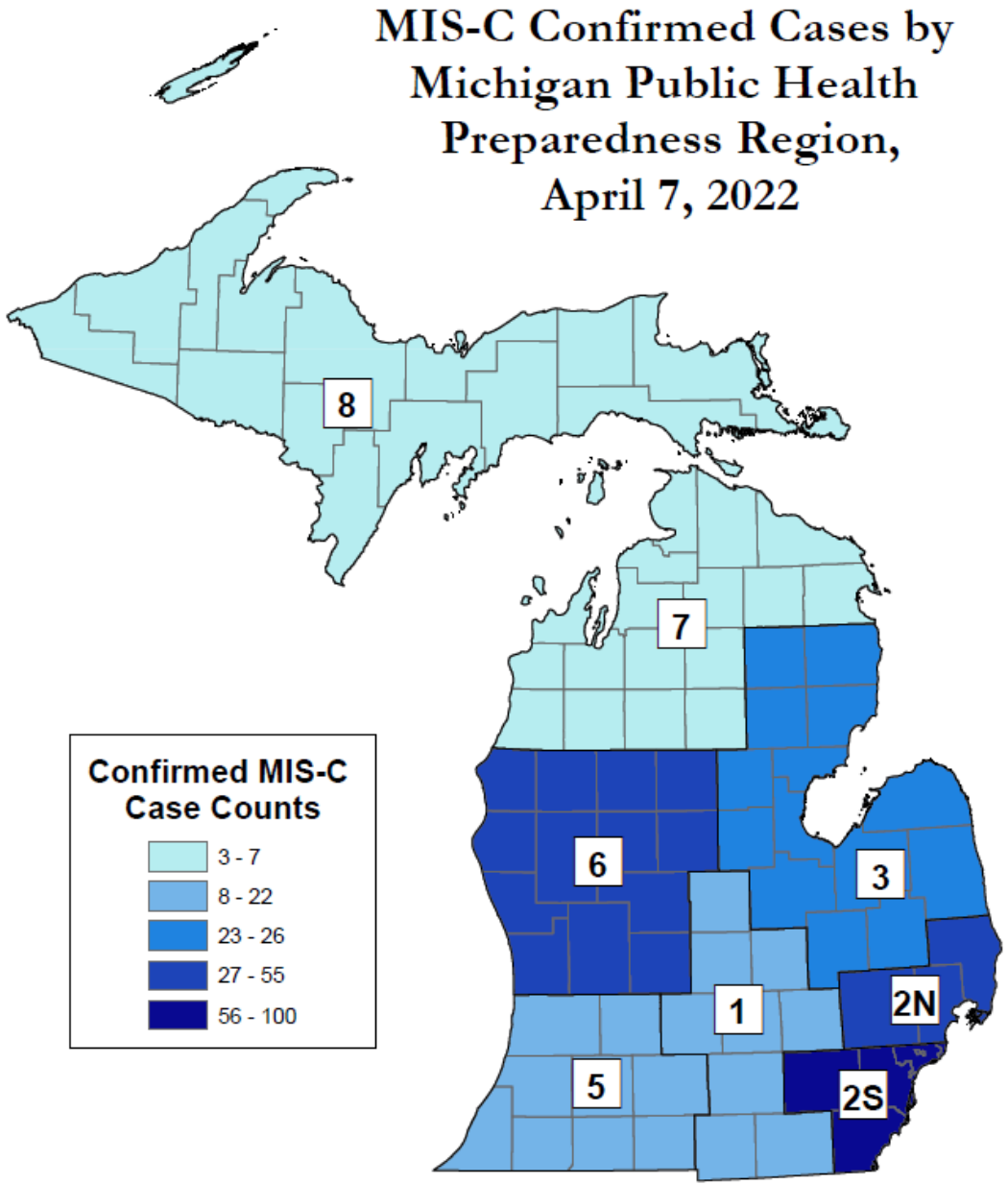
Source: CDC COVID Data Tracker and MDHHS and MIS-C Data and Reporting

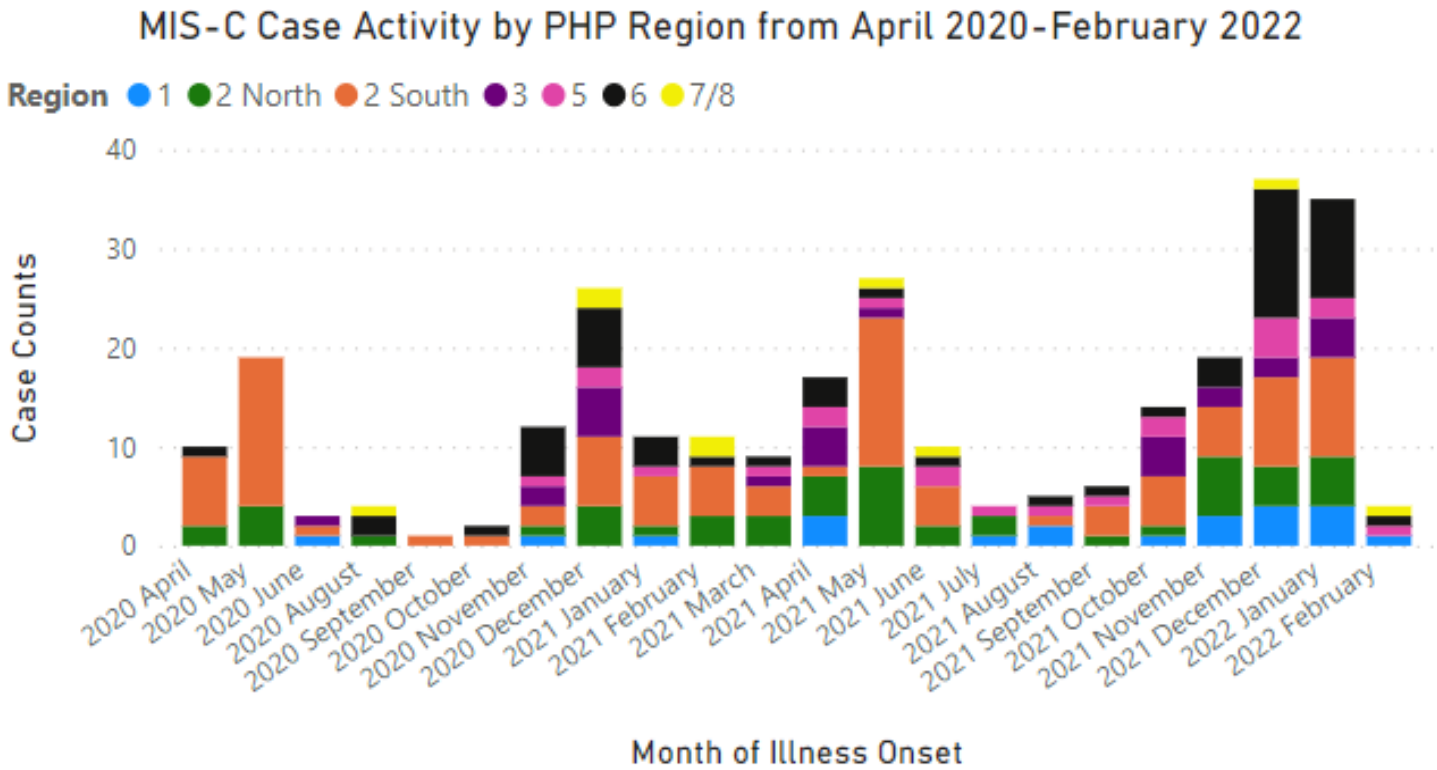
Payne AB, Gilani Z, Godfred-Cato S, et al. Incidence of Multisystem Inflammatory Syndrome in Children Among US Persons Infected With SARS-CoV-2. *JAMA Netw Open*. 2021;4(6):e2116420. doi:10.1001/jamanetworkopen.2021.16420

Reported MIS-C Case Ranges by Jurisdiction, on or before March 28, 2022*

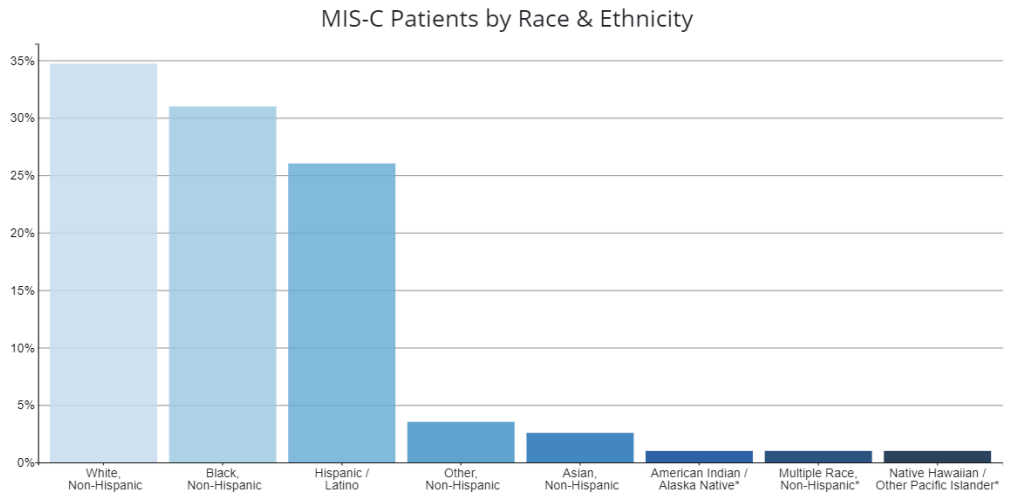


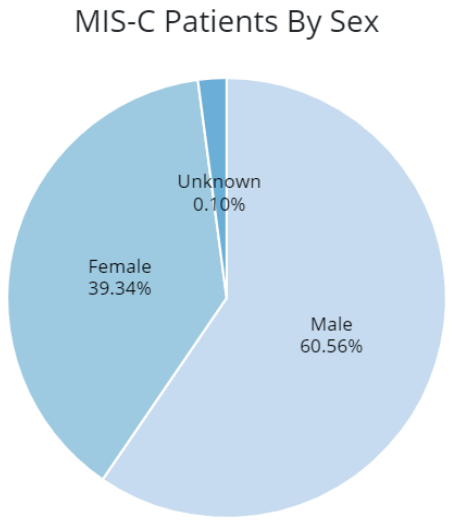
National Data Source: https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance


MIS-C Confirmed Cases by Michigan Public Health Preparedness Region, April 7, 2022
8
7
6
3
1
2N
5
2S
Confirmed MIS-C Case Counts
3 - 7
8 - 22
23 - 26
27 - 55
56 - 100

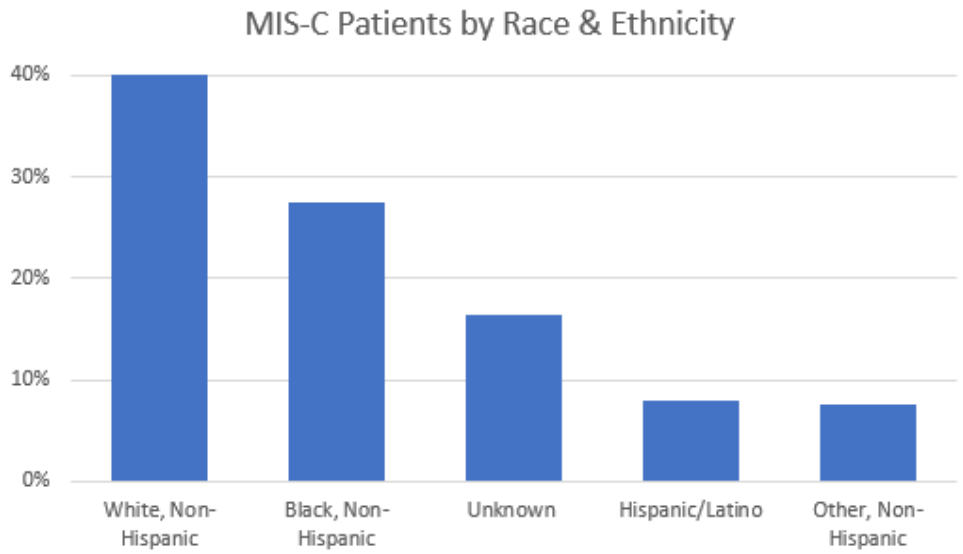

MIS-C Case Activity by PHP Region from April 2020-February 2022
Region 1 2 North 2 South 3 5 6 7/8
Case Counts
40
30
20
10
0
2020 April
2020 May
2020 June
2020 August
2020 September
2020 October
2020 November
2020 December
2021 January
2021 February
2021 March
2021 April
2021 May
2021 June
2021 July
2021 August
2021 September
2021 October
2021 November
2021 December
2022 January
2022 February
Month of Illness Onset

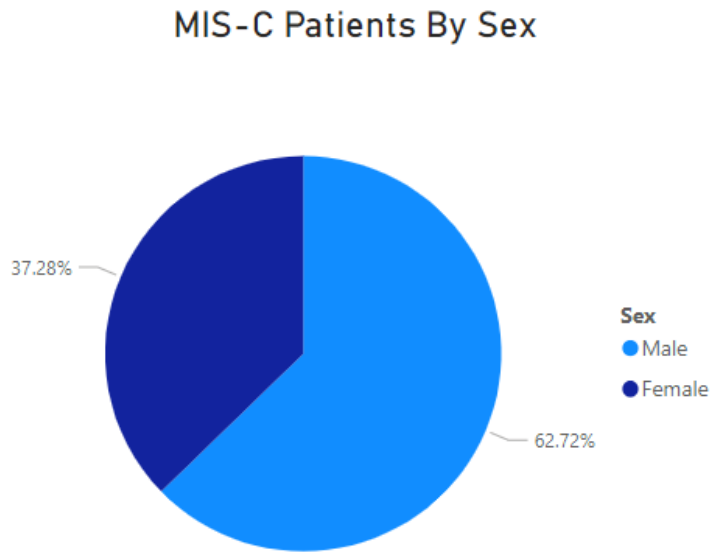
U.S.





Michigan





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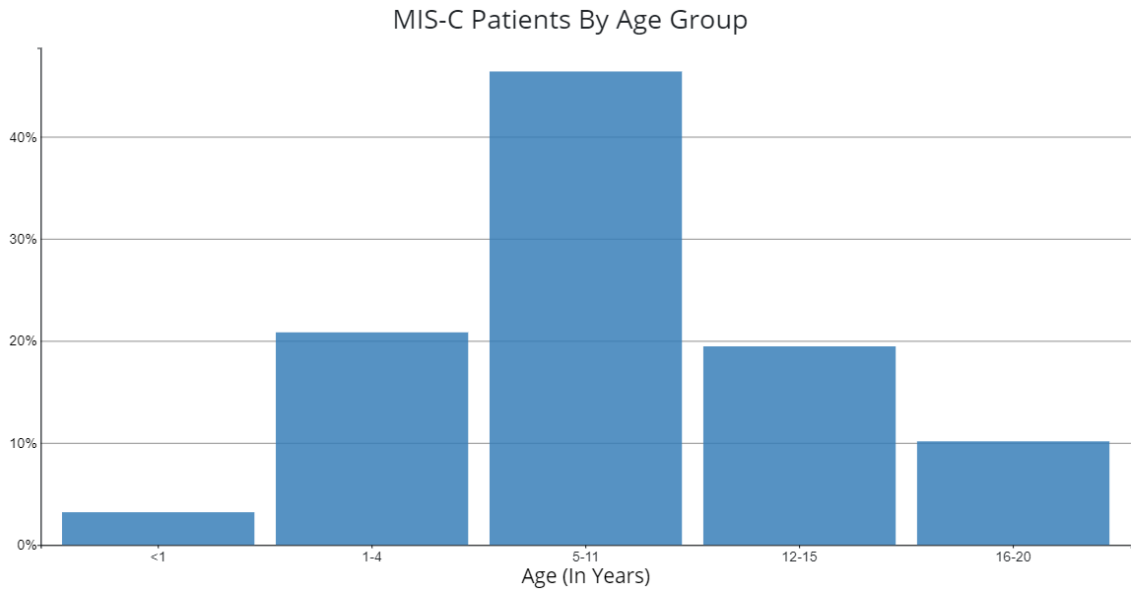
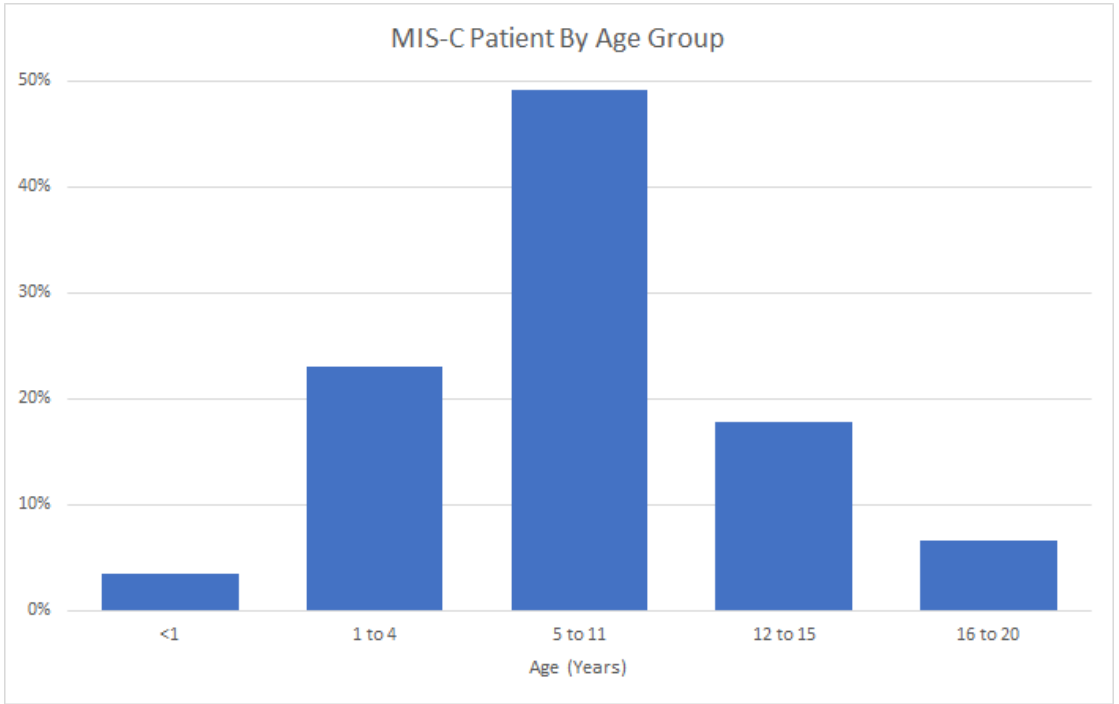
U.S.



Median Age: 9 Years

Michigan

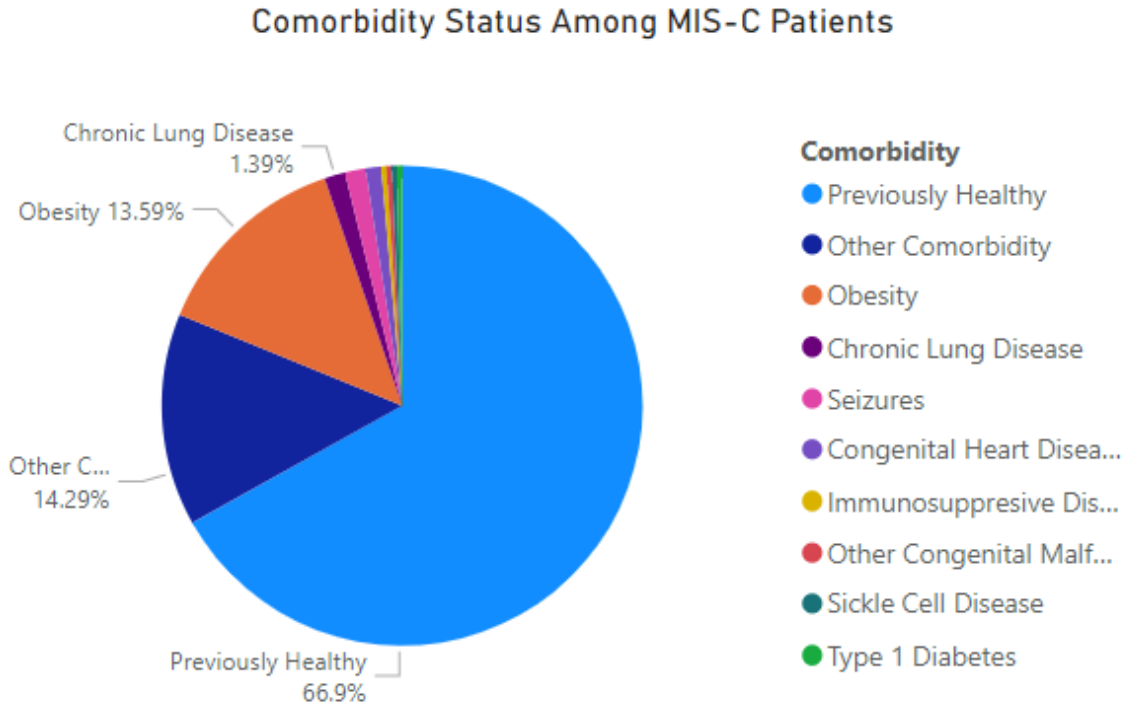


Median Age: 8 Years

National Data Source: https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance

MIS-C Michigan Data Summary

- Cases from 4/14/2020-02/28/2022:N=287
- ICU Rate: 65.5%
- Length of stay
  - Mean:7 days (SD: 5.48)
  - Median: 6 days
  - Range: 1-50 days
- Fatality rate: ~1%



MIS-C Michigan Data Summary

ORGAN SYSTEM	N	% OF TOTAL (N=287)
Hematologic	267	93
Cardiac	264	92
Gastrointestinal	243	84.7
Dermatologic	168	58.5
Renal	81	28.2
Respiratory	58	20.2
Neurological	21	7.3

MDHHS MIS-C Website

https://www.michigan.gov/coronavirus/stats/mis-c-reporting

- Information and resources are available for parents:
  - Clinical presentation information
  - What to expect for a child with suspected MIS-C
  - How to best protect children
- Information and resources for providers:
  - MDHHS and local health department contacts and reporting guidance
  - MIS-C Mortality Investigation and Reporting Guidance for Medical Examiners, Pathologists, and Healthcare Providers
  - Job Aid
- Additional resources and literature

MDHHS MIS-C Website

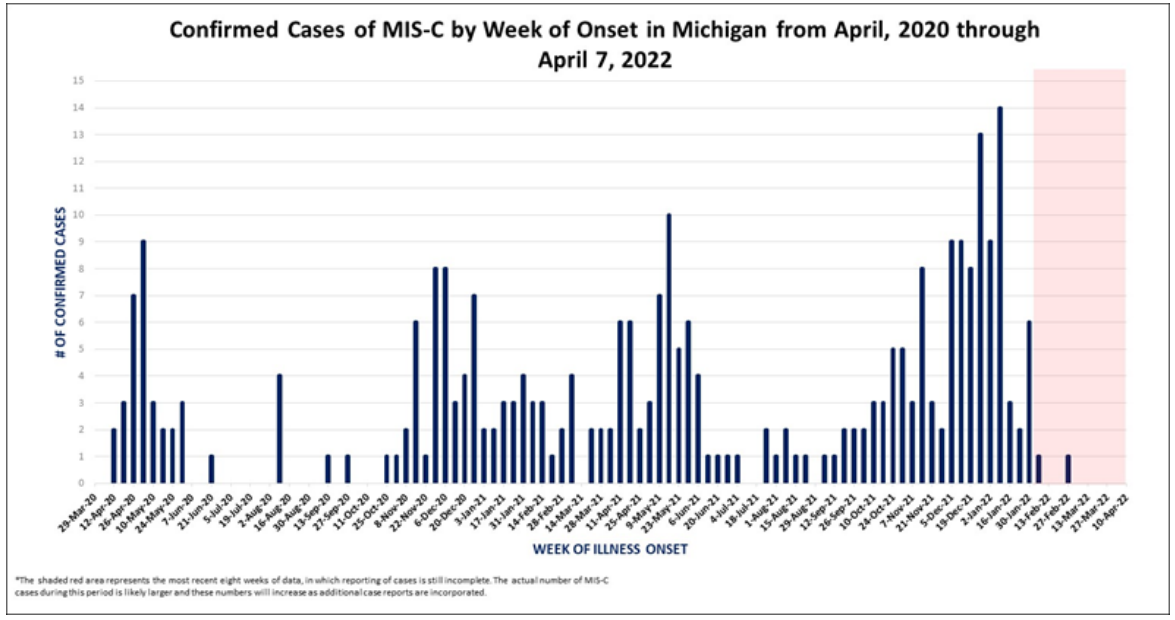
Multisystem Inflammatory Syndrome in Children (MIS-C) Michigan Data Summary 4/7/2022

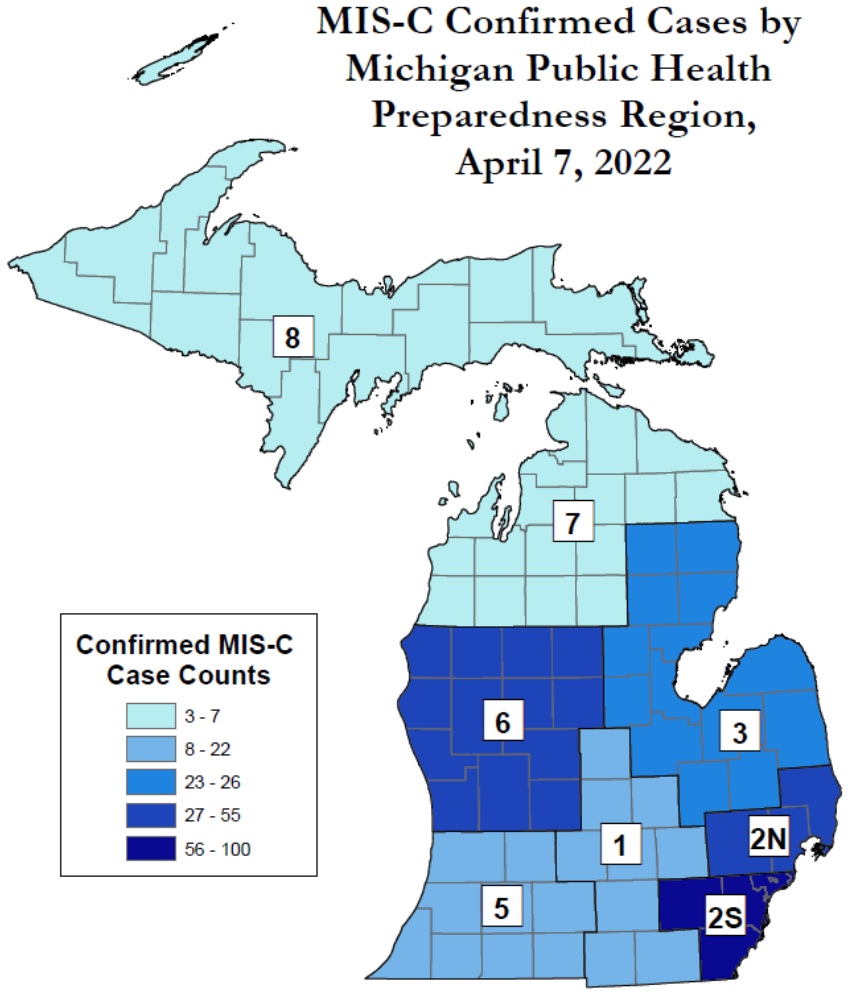
# Cases Confirmed and Reported to CDC*	**287**
MIS-C associated Deaths	5 or fewer
Cases admitted to ICU	188 (65.5%)
Onset Date Range	4/14/20 to 2/28/2022
Age Range	0-20 years

*Meets CDC Case definition
https://emergency.cdc.gov/han/2020/han00432.asp

DEMOGRAPHIC INFORMATION (N=287)

Age Group	**Count**	**%**	**Race**	**Count**	**%**
<1 yrs	10	3.5%	Black/African American	104	36.2%
1-4 yrs	66	23.0%	Caucasian	136	47.4%
5-11 yrs	141	49.1%	All Others / Unknown	47	16.4%
12-15 yrs	51	17.8%			
16-20 yrs	19	6.6%			
Gender	Counts	%	Ethnicity	Count	%
Male	178	62.0%	Not Hispanic or Latino	215	74.9%
Female	109	38.0%	Hispanic or Latino	23	8.0%
Unknown	0	0.0%	Unknown	49	17.1%





Questions?