NETEC

NETEC COVID-19 Webinar Series:

Pediatric Perspectives During a Pandemic

EMORY MEDICINE

UNMC Nebraska Medicine

NYC HEALTH+ HOSPITALS | Bellevue

Welcome

Amanda Grindle, MSN, RN

Overview

NETEC

- **Welcome**: Amanda Grindle, RN, MSN
- **Pediatric Perspective During a Pandemic**: Andi Shane, MD, MPH, MSc
- **Multi-System Inflammatory Disease in Children (MIS-C): The CHOA Experience** : Preeti Jaggi, MD
- **COVID-19 and the Heart: A Pediatric Perspective**: Matt Oster, MD, MPH
- **NETEC Resources**: Amanda Grindle, RN, MSN
- **Questions and Answers with NETEC**:

Welcome

NETEC

National Emerging Special Pathogens Training and Education Center

Mission Statement

To increase the capability of the United States public health and health care systems to safely and effectively manage individuals with suspected and confirmed special pathogens

For more information

Please visit us at www.netec.org
or email us at info@netec.org

NETEC Overview

NETEC

Assessment

Empower hospitals to gauge their readiness using
Self-Assessment

Measure facility and healthcare worker readiness using
Metrics

Provide direct feedback to hospitals via
On-Site Assessment

Education

Provide self-paced education through
Online Trainings

Deliver didactic and hands-on simulation training via
In-Person Courses

COVID-19 focused
Webinars

Technical Assistance

Onsite & Remote Guidance

Compile
Online Repository
of tools and resources

Develop customizable
Exercise Templates
based on the HSEEP model

Provide
Emergency On-Call Mobilization

Research Network

Online Repository
Built for rapid implementation of clinical research protocols

Develop Policies, Procedures and Data Capture Tools
to facilitate research

Create infrastructure for a
Specimen Biorepository

Cross-Cutting, Supportive Activities

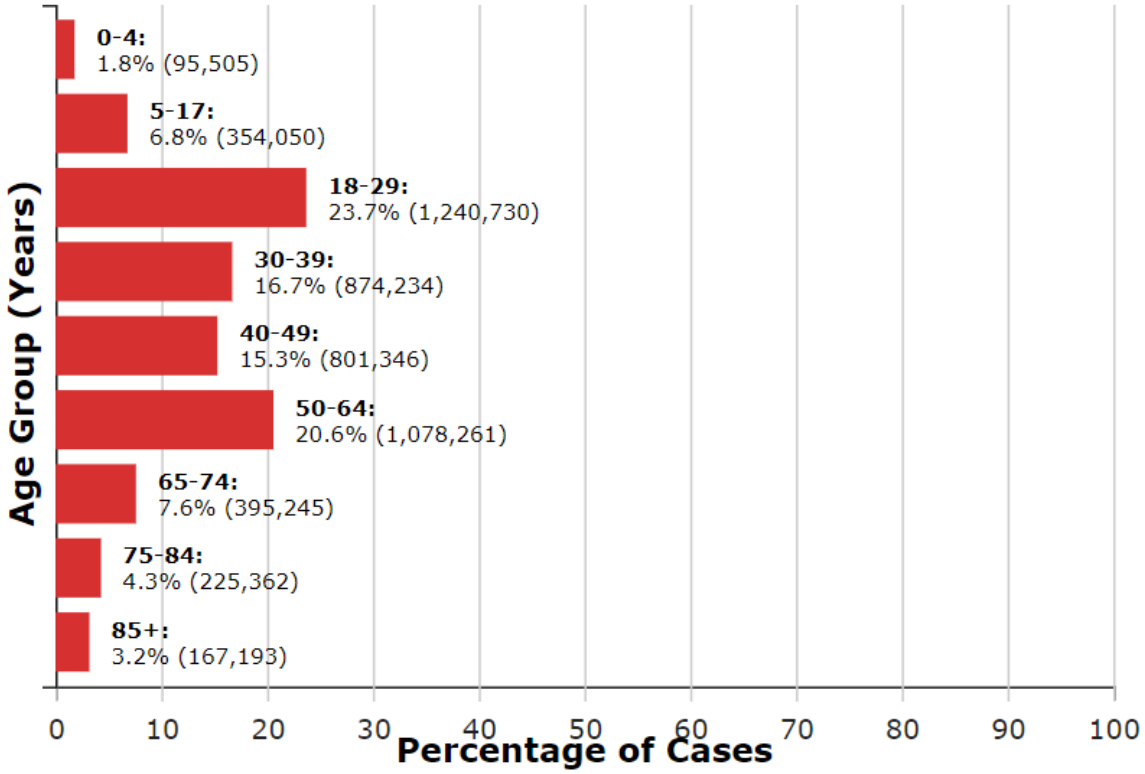
Pediatric Perspective During a Pandemic

Andi Shane, MD, MPH, MSc

Comparative Epidemiology of Acute COVID-19 in Children and Adults

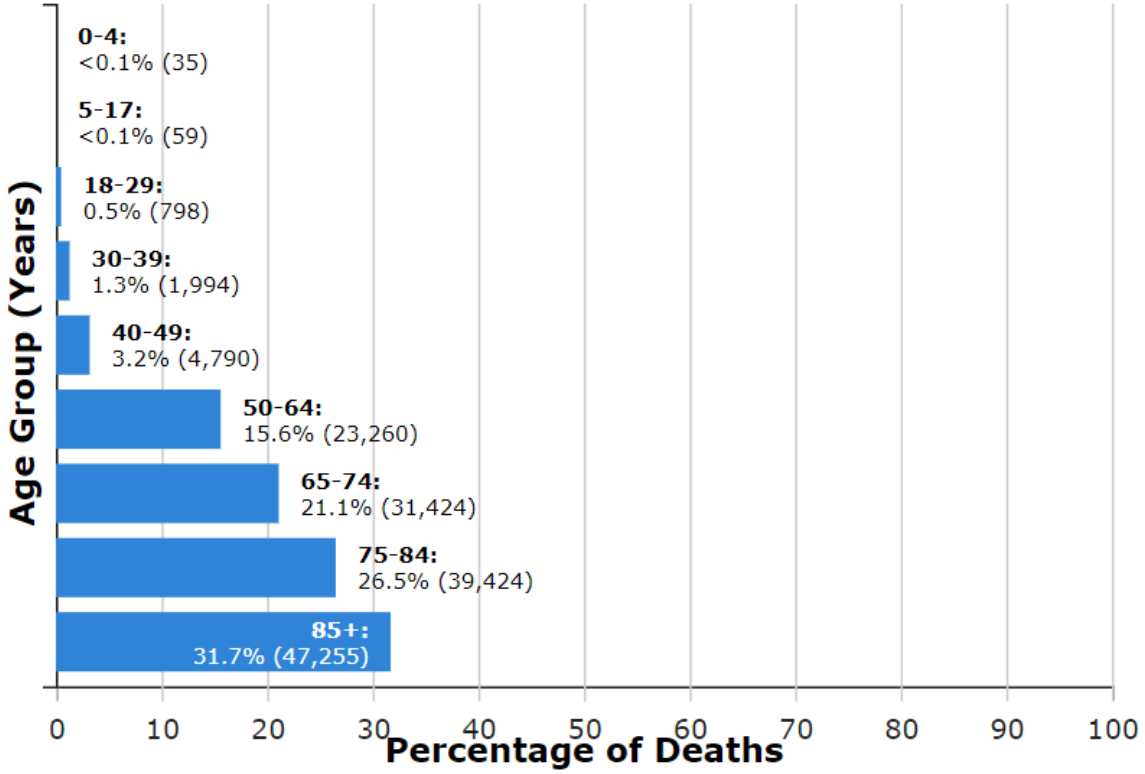
Cases by Age Group:

Data from 5,416,557 cases. Age group was available for 5,231,926 (96%) cases.



Deaths by Age Group:

Data from 149,049 deaths. Age group was available for 149,039 (99%) deaths.



https://covid.cdc.gov/covid-data-tracker; updated 02 Oct 2020

NETEC

Infection and Transmission Among Children

What we don't know:

- Are children as susceptible to infection by SARS-CoV-2 compared with adults?
- Can children transmit SARS-CoV-2 as effectively as adults?
- Does transmission result in infection, and does infection result in disease?

What we do know:

- Children likely have the same or higher viral loads in their nasopharynx compared with adults
- Children can transmit SARS-CoV-2 effectively in households and camp settings

Pediatric Perspectives During a Pandemic

NETEC

Burden of COVID-19 in Children

- Less likely to develop severe illness compared with adults
- Children still at risk of developing severe illness and complications
- Rate of hospitalization among children is low (8.0 /100,000) compared with adults (165 /100,000 population); may be increasing
- Children have lower rates of mechanical ventilation and death than adults
- Of the children who have developed severe illness, most with underlying medical conditions including obesity, diabetes, asthma and chronic lung disease
- Most who are infected with SARS-CoV-2 do not usually develop severe illness

https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html accessed 02Oct2020

Pediatric Perspectives During a Pandemic

NETEC

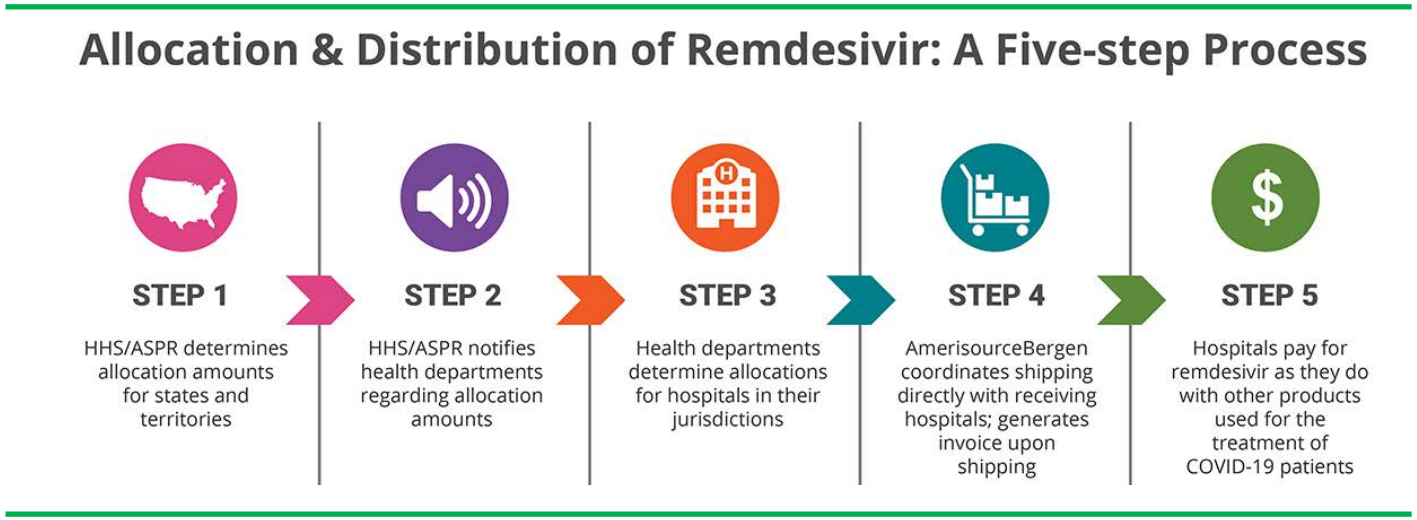
Hospitalization Associated with Acute COVID-19 in Children

- Hospitalization rates in the United States are higher among Hispanic/Latino children and black, non-Hispanic children and non-Hispanic black children compared with white children
  - May be related to higher rates of obesity and other underlying conditions among these populations
- Similar to adults, children with severe COVID-19 may develop respiratory failure, myocarditis, shock, acute renal failure, coagulopathy, and multi-organ system failure
- Some children have developed appendicitis, intussusception or diabetic ketoacidosis
- Children infected with SARS-CoV-2 are also at risk for developing multisystem inflammatory syndrome in children (MIS-C)

https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html accessed 02Oct2020

Clinical Management

- Treatment of COVID-19 in children is mostly supportive; intervention may be needed in some who are hospitalized
- Remdesivir, with variable results in clinical trials in adults, is now available for purchase



- The safety and effectiveness of Remdesivir for treatment of COVID-19 is being evaluated in children (*NCT04431453)*
- The National Institutes of Health (NIH) suggests that dexamethasone may be beneficial in pediatric patients with acute COVID-19 respiratory disease who are receiving mechanical ventilation[1]
- Children infected with SARS-CoV-2 can present with other serious conditions such as diabetic ketoacidosis or intussusception, and a broad differential must be maintained

[1] https://files.covid19treatmentguidelines.nih.gov/guidelines/section/section_45.pdf accessed 02Oct2020

Pediatric Perspectives During a Pandemic

NETEC

Challenges to Family Centered Care

- Visitor restrictions
- Essential personnel only in room
- Common areas for siblings closed
- PPE frightening to children
- Decreased ability to communicate wearing masks
- Children unable or unwilling to wear masks

Pediatric Perspectives During a Pandemic

NETEC

Advocate for Children in Treatment and Prevention Trials

- Advocacy for children's participation in treatment trials
  - 107 current studies listed in COVID-19 Studies from the World Health Organization Database
  - 383 current studies in ClinicalTrials.gov
- Advocacy for inclusion of children in vaccine studies

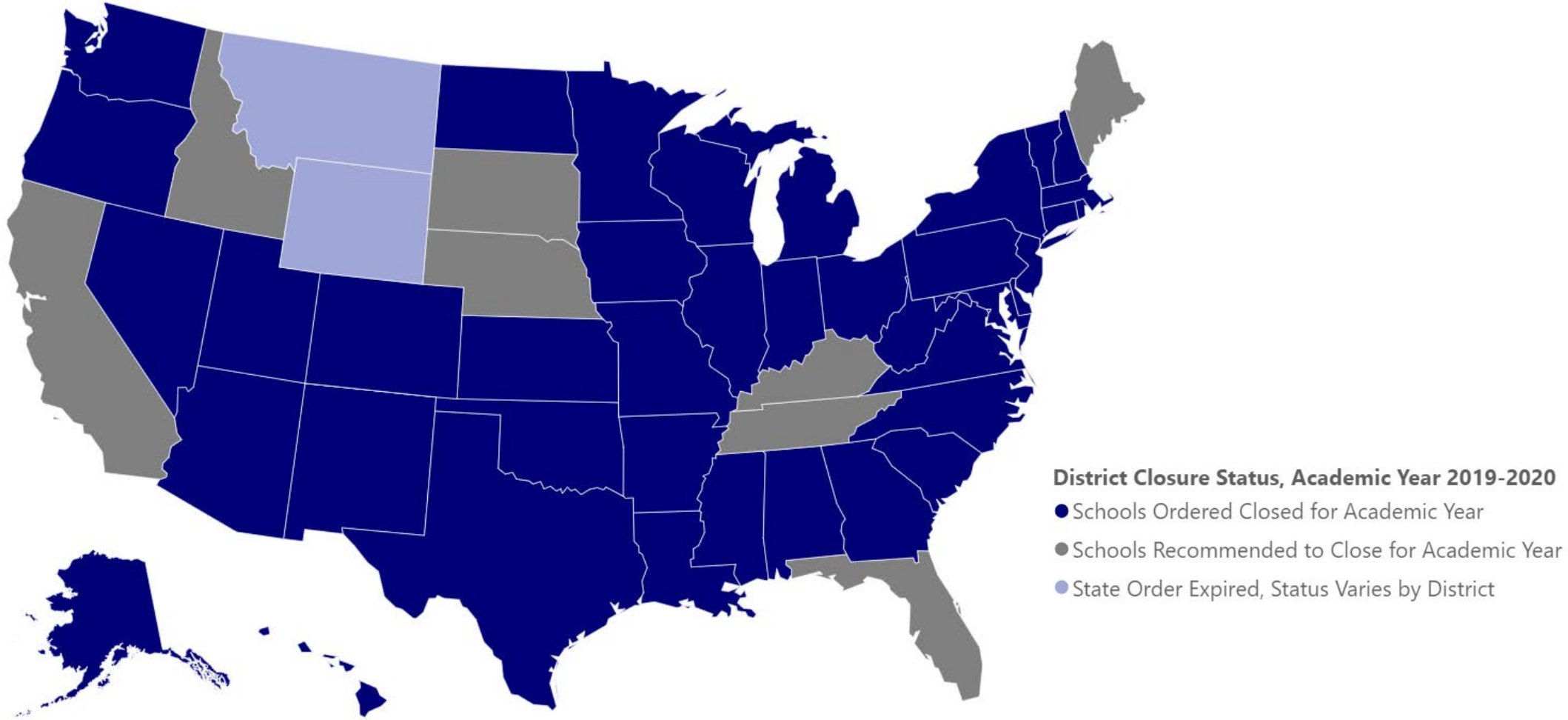
Well Child Care

- Shelter-in-place orders resulted in declines in outpatient pediatric visits and fewer vaccine doses administered during the early COVID-19 pandemic
- Clinicians should work with families to keep children up to date with all recommended vaccinations by identifying children who have missed well-child visits and/or recommended vaccinations and contact them to schedule in-person appointments, with prioritization of infants, children age < 24 months and school-aged children
- Developmental surveillance and early childhood screenings, including developmental and autism screening, should continue along with referrals for early intervention services
- All newborns should be seen by a pediatric healthcare provider shortly after hospital discharge (three to five days of age in-person, to evaluate feeding and weight gain, check for dehydration and jaundice, ensure all components of newborn screening were completed with appropriate confirmatory testing and follow-up, and evaluate maternal well-being
- Clinicians should educate patients and families about infection prevention in clinics, emergency departments, hospitals, and clinics

https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html accessed 02Oct2020

K-12 School Closures

Status of COVID-19 Pandemic-Associated Public K-12 School Closures – United States, February 18 – June 30, 2020 (Archived)



https://covid.cdc.gov/covid-data-tracker; updated 13 Aug 2020

Pediatric Perspectives During a Pandemic

NETEC

Return to School

- Children with symptoms of <u>any</u> infectious disease should not attend school
- The length of isolation depends on the most likely etiology of illness
- Return to school policies for children with COVID-19 based on local epidemiology
- A negative test or excuse note should not be required for return to school upon completion of the 10 days of isolation with improvement of symptoms
- If a child is assessed to likely not have COVID-19 by a clinician, he/she should be allowed to return to school according to existing school policies for non-COVID illnesses (resolution of fever without antipyretics for 24 hours for non-COVID viral illnesses or after initiation of antibiotics for bacterial illnesses, if indicated)

https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html accessed 02Oct2020

Multi-System Inflammatory Disease in Children (MIS-C): The CHOA Experience

Preeti Jaggi, MD

Background

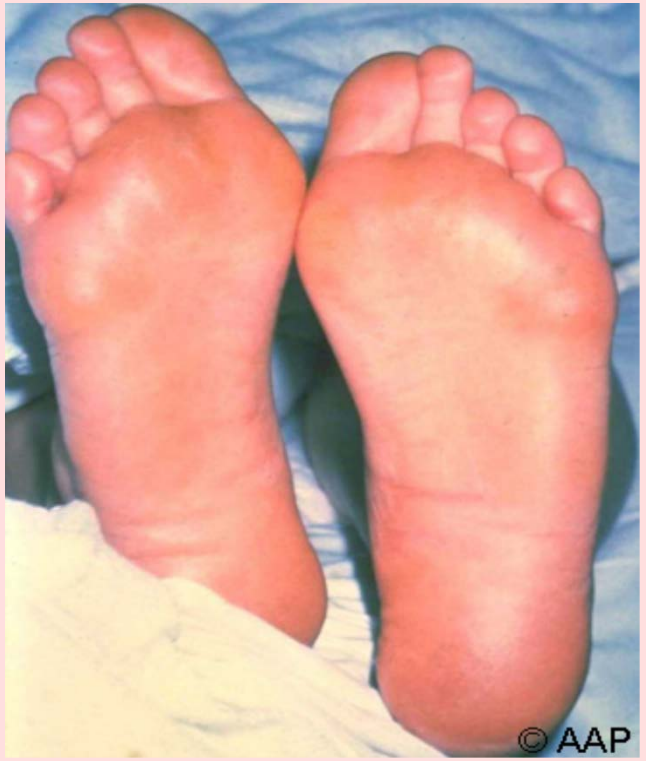
- SARS CoV-2 generally causes less severe acute illness in children
- April 27, alert from the NHS: cases of severe myocardial dysfunction, some with features of Kawasaki disease, and several with shock requiring vasopressive medications as supportive care
- Later this was described in NYC and throughout areas in the US
- Features similar to Kawasaki disease

Similar	Conjunctival injection, rash, coronary dilation
Different	Older age, higher percentage with shock

- Features similar to toxic shock syndrome

Similar	Diffuse rash, shock, thrombocytopenia, multi-system involvement
Different	Rash mostly not diffuse erythroderma

Toxic Shock Syndrome



Red Book® Online

Date of download: 8/5/2015 Copyright © 2015 American Academy of Pediatrics

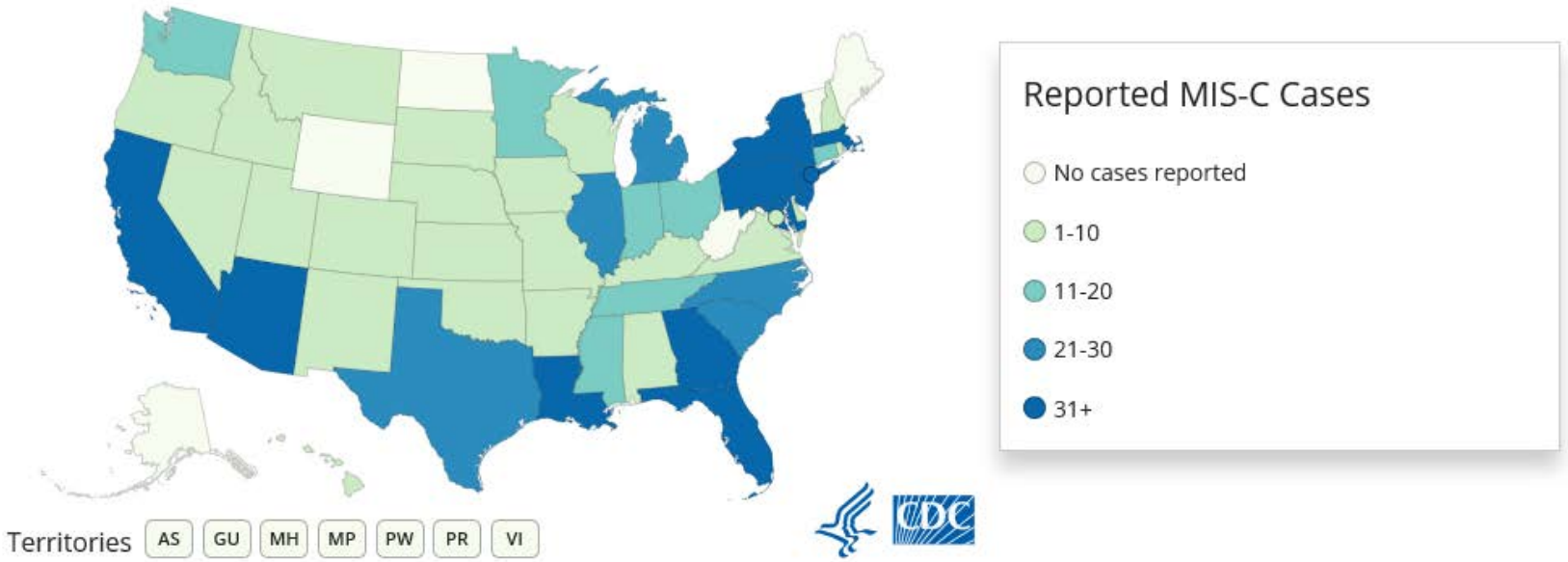
Multi-System Inflammatory Disease in Children (MIS-C): The CHOA Experience

NETEC

Background

- Features similar to rheumatologic illness
  - HLH/macrophage activation syndrome: cytopenia, hyper-inflammatory state
  - State seen in underlying rheumatologic illness such as JIA, SLE
- MIS-C: Most greater than 5 years of age
- Abdominal complaints (pain, diarrhea, vomiting) in about half
- Most are otherwise healthy
- Epidemiology seems to follow approximately one month after peaks of community COVID-19 cases

Health Department – Reported Cases of Multisystem Inflammatory Syndrome in Children (MIS-C) in the United States (N=935)

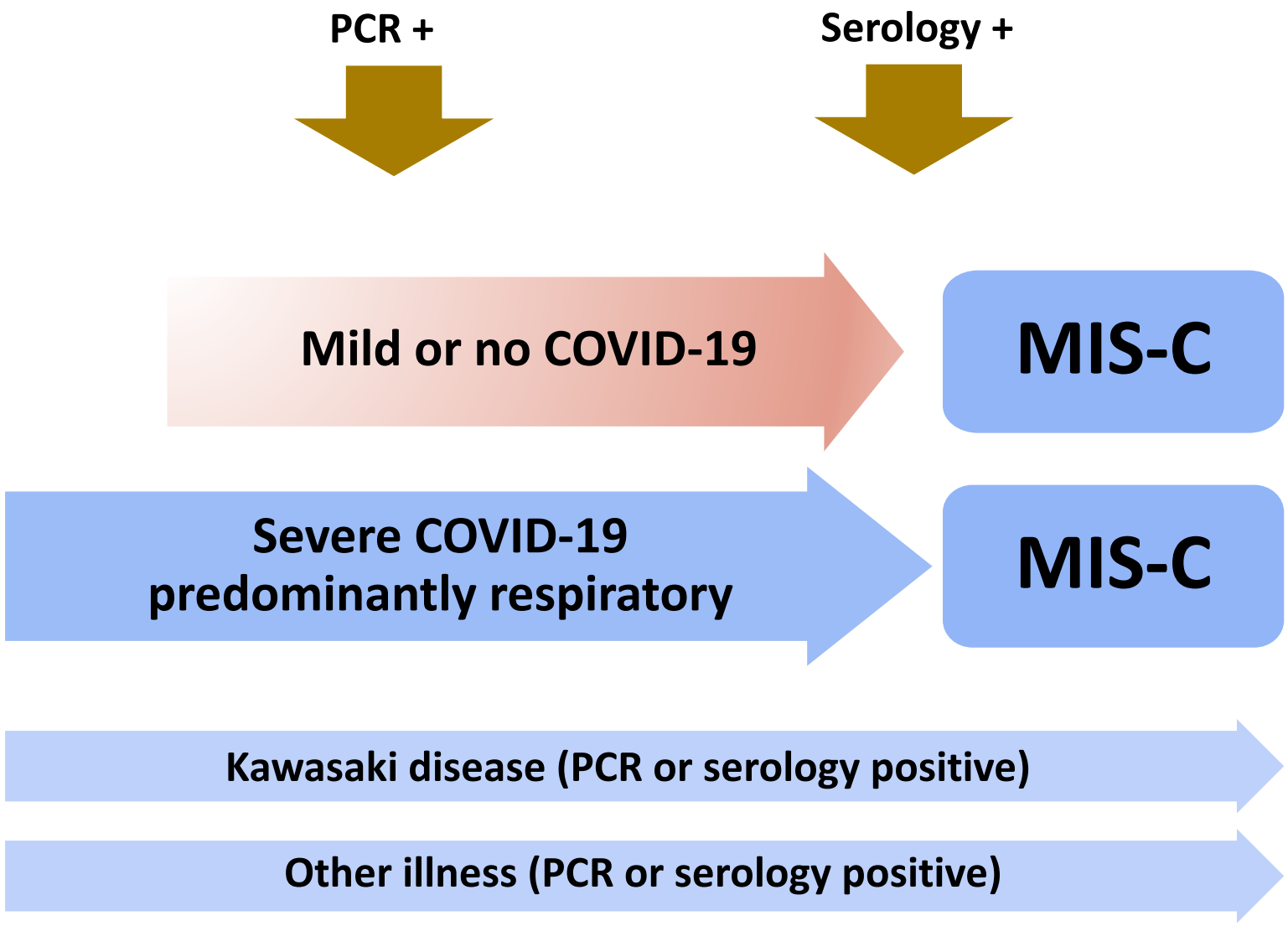


42% Hispanic, 33% Black/non Hispanic, 14% White non-Hispanic, 2% Asian

55% Males

Over 50% are 5-14 years of age

MIS-C: Likely Many Scenarios

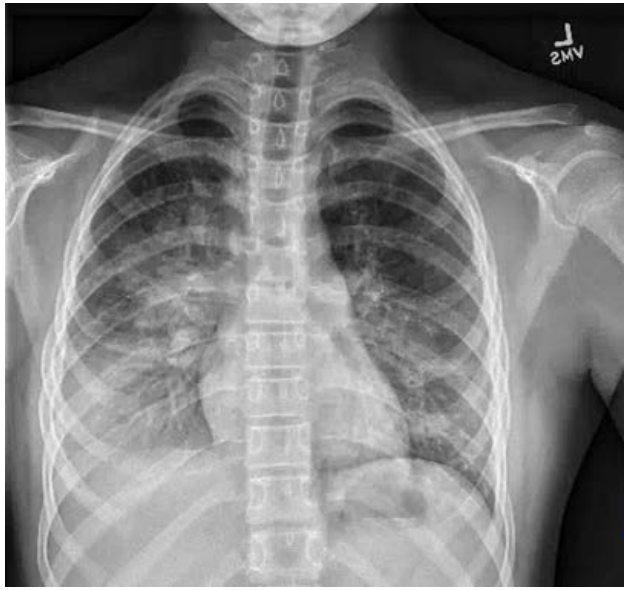


Meet MIS-C Case Definition

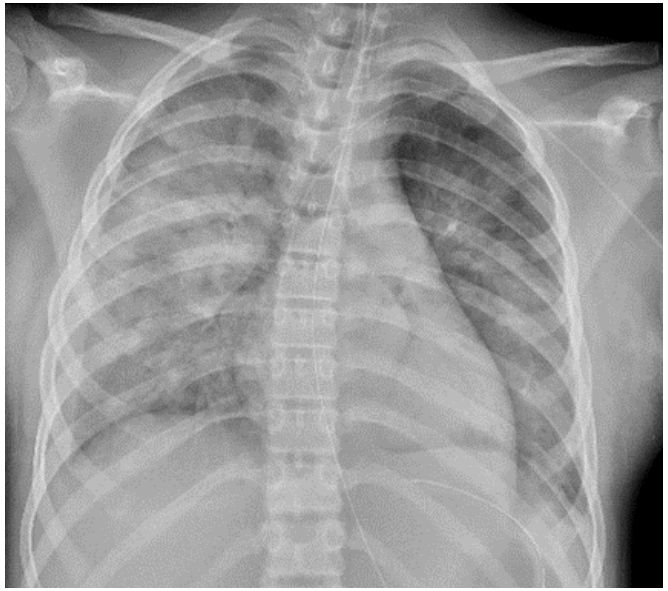
- Fever
- Evidence of inflammation
- 2 organ systems
- "Severe" illness
- No other plausible diagnosis
- Evidence of serologic conversion, contact, or NP +

12-Year-Old..

- 12 y/o: Day 2 of illness: Came to ED with fevers, vomiting
- Day 3 of illness: Returned to ED with persistent fevers, new cough
- Day 5 of illness: Returned to ED with fevers, SOB
  - 39.6°C HR 129 BP 108/63 RR 26-40 89% O2 saturation
  - Due to increased distress on HFNC 15L 100%, transferred to PICU for BiPAP



HD #1



HD #3

Patel; Pediatrics, 2020

7-Year-Old..

1

D#1

- Fevers ranged from 102-104F
- Abd pain is constant, diarrhea, vomiting
- NBNB emesis 1-2 episodes per day
- Rash: “red dots like mosquito bites” on palms

2

D#2

- Progresses to have conjunctival injection and dry, cracked lips
- Rx Zofran for presumed AGE
- Rash progressed → red and splotchy on shoulders, arms, back

3

D#5

- Neck pain
- Hypotension
- Decreased left ventricular function
- Admitted to ICU, treated with IVIG and eventually improves

COVID-19 and Kawasaki Disease: Novel Virus and Novel Case

- 6 mo with fever, fussiness, decreased PO
- Rash on day 2
- Irritability, limbic-sparing conjunctivitis, and dry lips on day 4
- Swelling of hands on day 5
- Left shift, anemia, elevated CRP and ESR, low albumin
- Treated with IVIG and high dose ASA
- Echo normal
- SARS-CoV-2 RT-PCR positive from admission

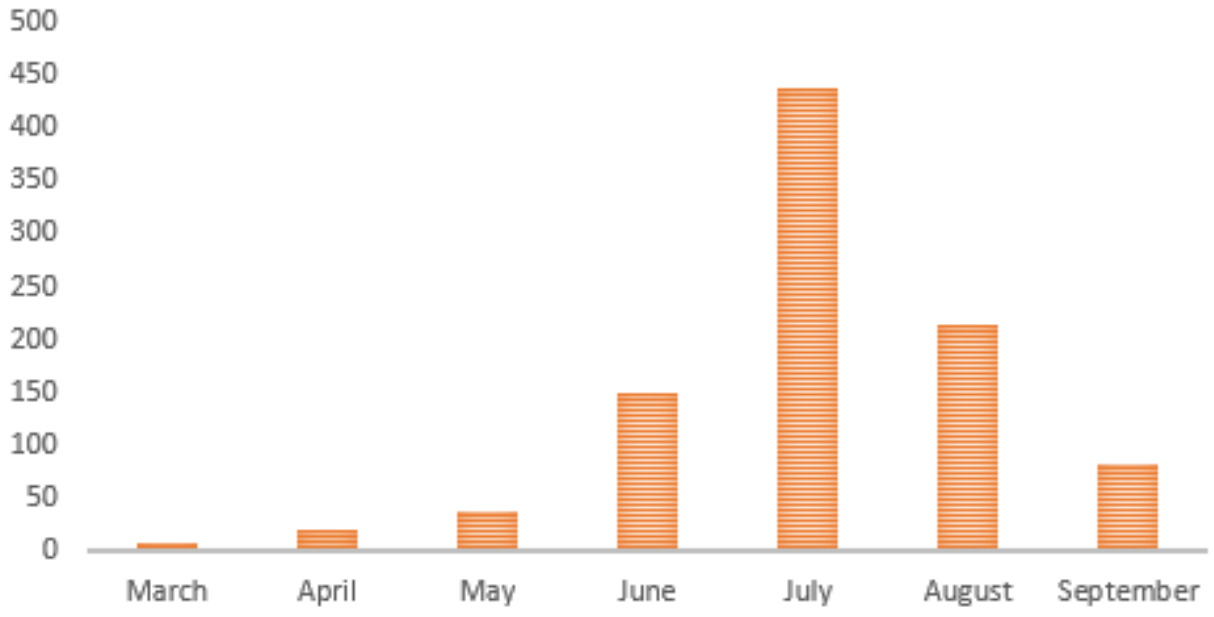
Figure 1. Bulbar conjunctival injection.

Image shared with parental permission.

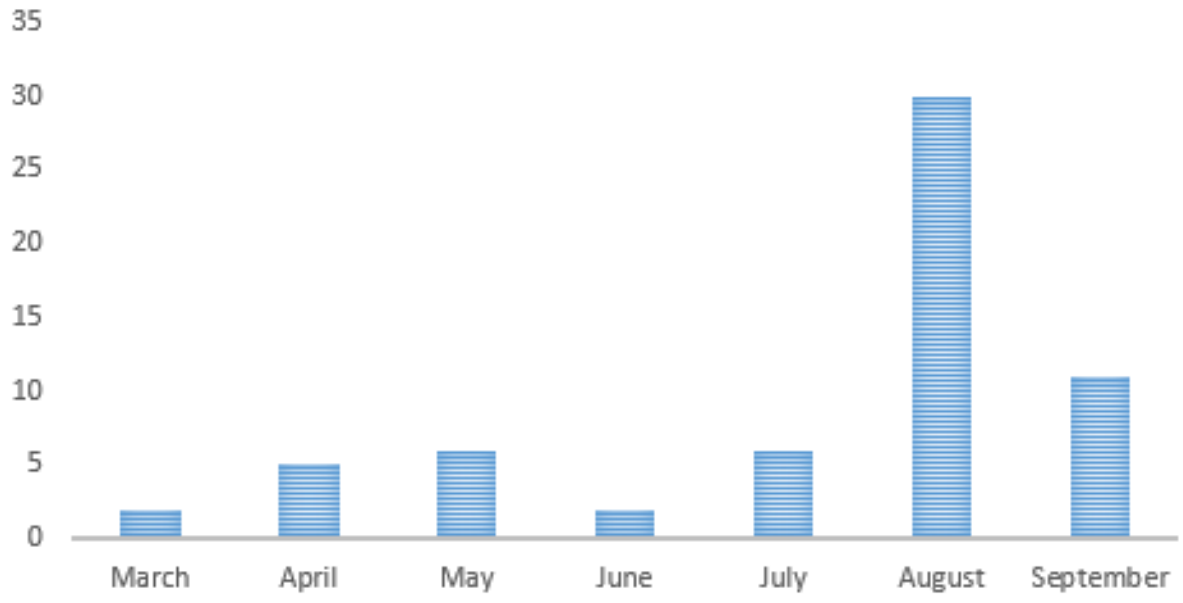
Jones, VG, Hospital Pediatrics 2020

CHOA Cases

Symptomatic, NP SWAB +



MIS-C Cases



Demographics in Acute COVID versus MIS-C

	Acute COVID (n=952)	MIS-C (n=57)	P value
Age, median (IQR)	10.26 (2.5-15)	8.26 (5.9-11.9)	NS
Gender, % male	52.5%	59.6%	NS
Ethnicity, Hispanic	364 (38.2%)	16 (28%)	NS
Race, Black	376 (39.4%)	38 (67%)	p<0.001

Severity of Illness in Children with MIS-C

	Total
Length of stay, days	7, median (IQR 4-9)
% requiring ICU care	74% (41/55)
Myocardial dysfunction	60%
Immunomodulators (anakinra, tocilizumab)	8.6%
Vasoactive medications	57%

Multi-System Inflammatory Disease in Children (MIS-C): The CHOA Experience

NETEC

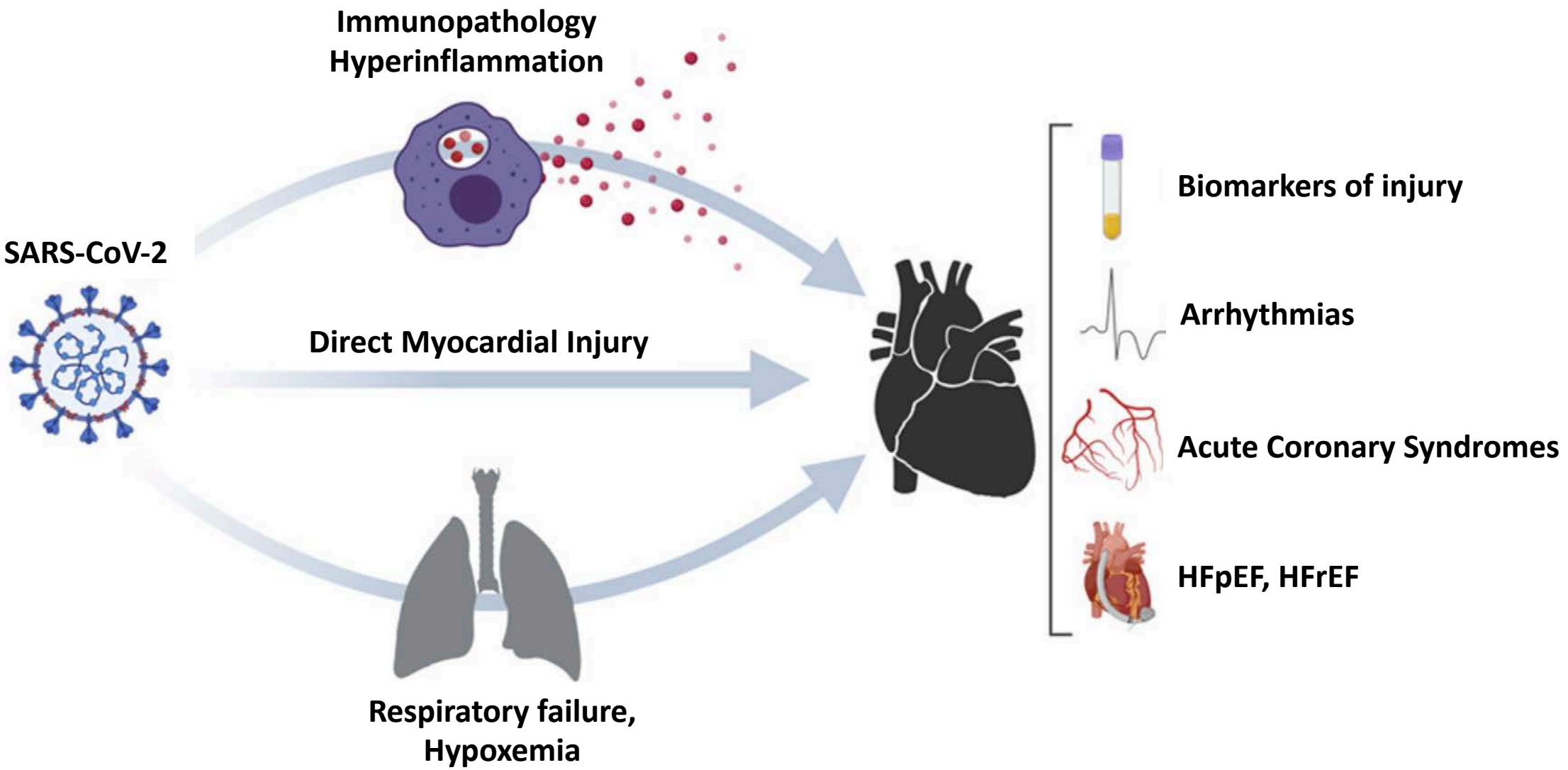
Preliminary Observations

- MIS-C is probably a collection of syndromes
  - Acute infection with severe disease
  - Post infection after an undetectable initial illness
- MIS-C may disproportionately affect Black children
  - Don’t know infection rates in asymptomatic children
- MIS-C is associated with severe illness
- Using quantitative serology, MIS-C appears most similar to convalescent COVID

COVID-19 and the Heart: A Pediatric Perspective

Matt Oster, MD, MPH

Proposed Mechanisms of Cardiac Injury



Akhmerov and Marbán. *Circulation Research* 2020

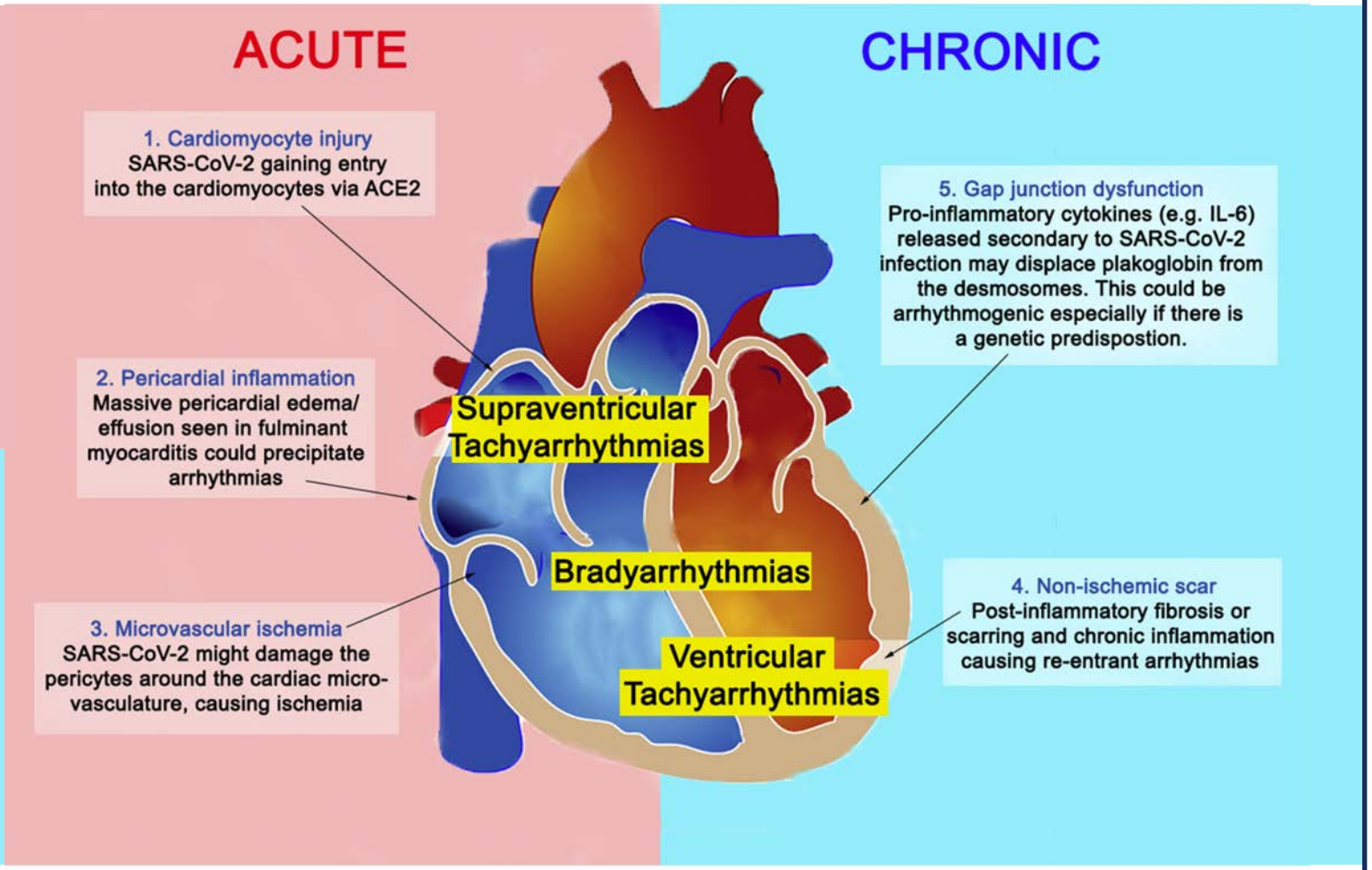
COVID-19 and Cardiac Involvement

Acute involvement

- Not seeing a lot in children (but are we really checking?)

Long-term

- Myocarditis?
- Arrhythmias?
  - Sinus bradycardia?



re 2 Arrhythmogenesis in SARS-CoV-2–related myocarditis. Possible mechanisms responsible for arrhythmias in SARS-CoV-2–related myocarditis are vn. Mechanisms 1, 2, and 3 could occur in the acute setting, whereas mechanisms 4 and 5 occur in chronic/healed myocarditis. Abbreviations as in Figure 1.

Siripanthong et al. *Heart Rhythm* 2020.

Acute Effects in Children

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 69
August 7, 2020

Hospitalization Rates and Characteristics of Children Aged <18 Years Hospitalized with Laboratory-Confirmed COVID-19 — COVID-NET, 14 States, March 1–July 25, 2020

New clinical discharge diagnoses (N = 208)				
Pneumonia	23/208 (11.1)	2/61 (3.3)	2/24 (8.3)	19/123 (15.4)
Multisystem inflammatory syndrome in children (MIS-C)[†††]	9/83 (10.8)	1/15 (6.7)	5/15 (33.3)	3/53 (5.7)
Acute respiratory failure	10/208 (4.8)	0/61 (—)	3/24 (12.5)	7/123 (5.7)
Acute kidney injury	6/208 (2.9)	0/61 (—)	0/24 (—)	6/123 (4.9)
Diabetic ketoacidosis	6/208 (2.9)	0/61 (—)	0/24 (—)	6/123 (4.9)
Acute respiratory distress syndrome	4/208 (1.9)	1/61 (1.6)	0/24 (—)	3/123 (2.4)

Kim *et al. MMWR* 2020

Multisystem Inflammatory Syndrome: Cardiac Involvement

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 69
August 7, 2020

COVID-19–Associated Multisystem Inflammatory Syndrome in Children — United States, March–July 2020

Cardiovascular	493 (86.5%)
Shock	202 (35.4%)
Elevated troponin	176 (30.9%)
Elevated BNP or NT–proBNP	246 (43.2%)
Congestive heart failure	40 (7.0%)
Cardiac dysfunction§	207 (40.6%)
Myocarditis	130 (22.8%)
Coronary artery dilatation or aneurysm§	95 (18.6%)
Hypotension	282 (49.5%)
Pericardial effusion§	122 (23.9%)
Mitral regurgitation§	130 (25.5%)

Godfred-Cato *et al. MMWR* 2020

NETEC

What is Myocarditis?

- Inflammatory disease of the heart muscle
- Male predominance
- Primarily young adults

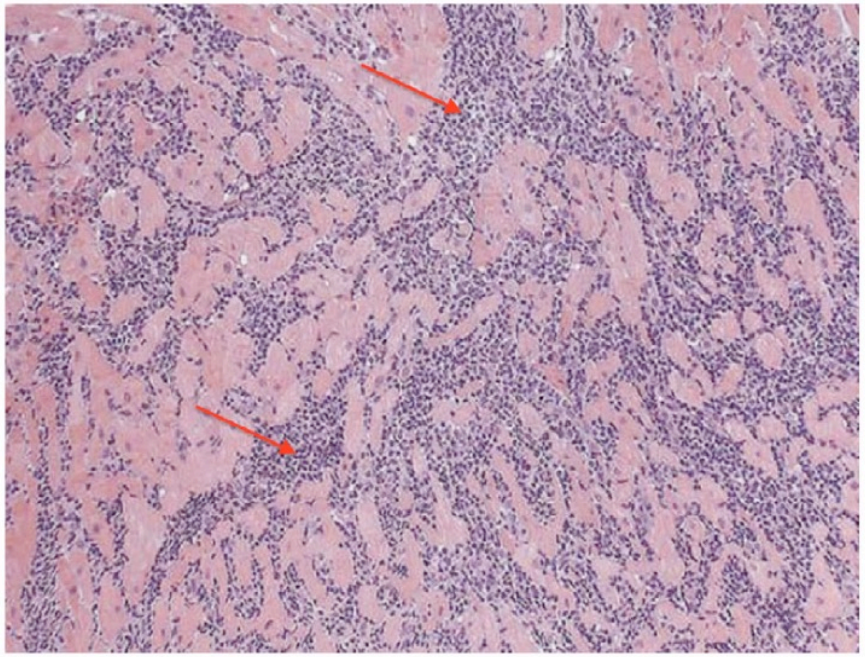


FIGURE 3 An endomyocardial biopsy specimen of a 15-year-old male with myocarditis. This biopsy specimen demonstrates diffuse neutrophilic infiltration (red arrows) indicative of myocardial inflammation

Dasgupta et al. *CHD* 2019.

NETEC

Why Do We Care About Myocarditis?

- Cause of death in 9% of athletes in whom a cardiovascular event was documented[1]
- Of 243 analyzed cases of sudden death in ages 1-17yo in 2015-2016, 19 (8%) had myocarditis or endocarditis[2]

[1]Maron et al. *Circulation* 2009.

[2]Burns et al. *Journal of Pediatrics* 2020.

NETEC

Myocarditis in Adults

JAMA Cardiology

JAMA Cardiology | Original Investigation

Outcomes of Cardiovascular Magnetic Resonance Imaging in Patients Recently Recovered From Coronavirus Disease 2019 (COVID-19)

- German study of 100 adults
  - Median age 49
  - 1/3 hospitalized, 2/3 at home (with 18 asymptomatic)
  - MRI 2-3 months after COVID infection
    - Cardiac involvement by MRI in 78%, with 60% with ongoing inflammation

Puntmann *et al. JAMA Cardiology* 2020

NETEC

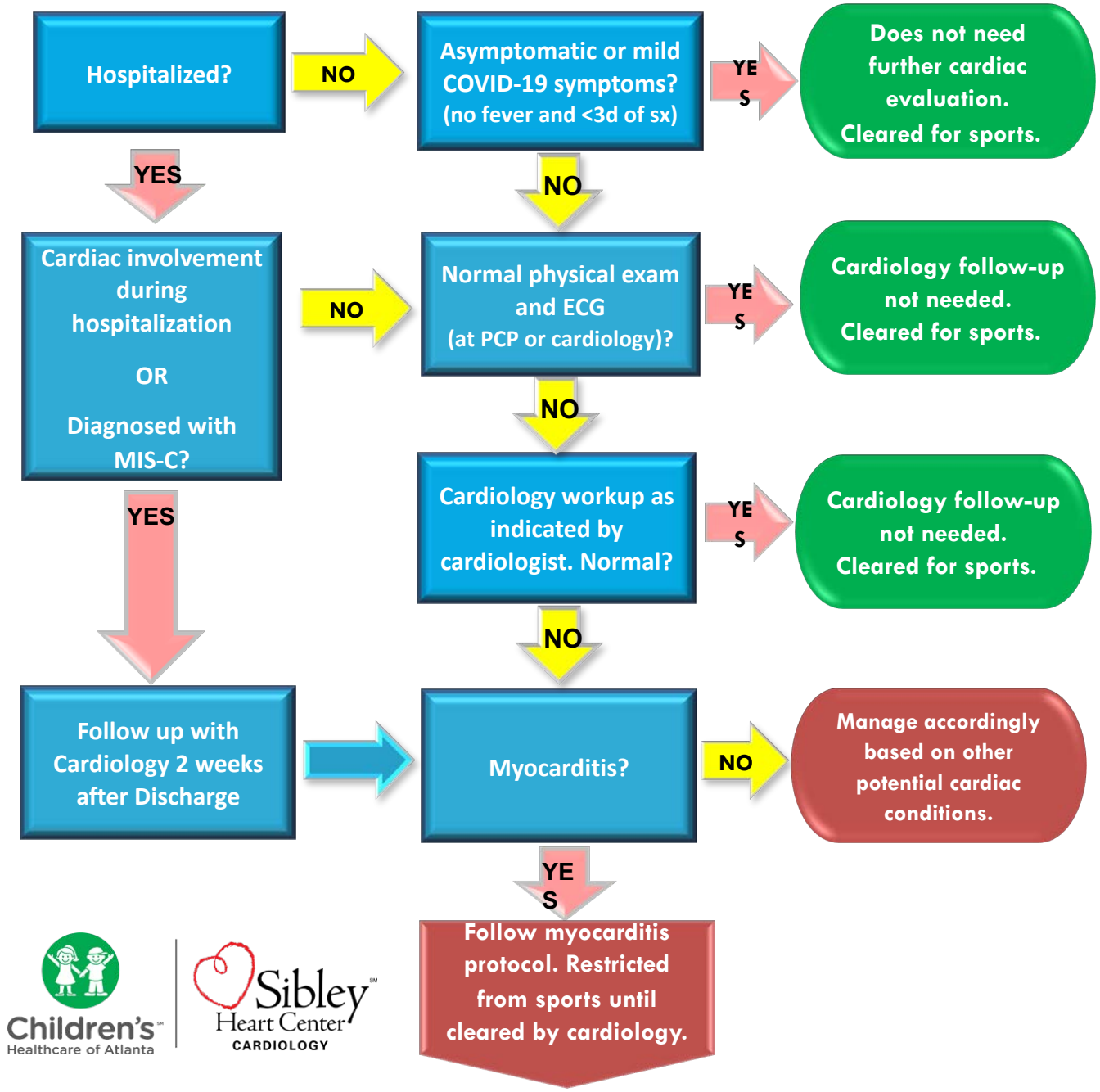
Myocarditis in College Athletes

RESEARCH LETTER

Cardiovascular Magnetic Resonance Findings in Competitive Athletes Recovering From COVID-19 Infection

- 26 college athletes, 4 of whom met CMR criteria for myocarditis
  - 0/10 females had myocarditis, 4/16 males)
- 12 subjects had mild symptoms during acute infection (2 of the 4 with eventual myocarditis)
- 0 subjects had ST/T wave changes on ECG, elevated troponin, or abnormal ventricular size or function by echo

Rajpal *et al. JAMA Cardiology* 2020



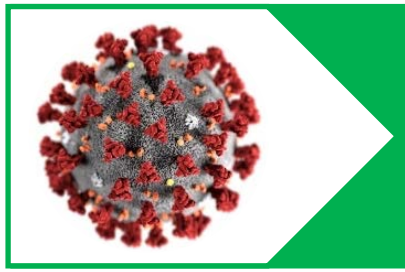
Children's Healthcare of Atlanta | Sibley Heart Center CARDIOLOGY

MIS-C Follow-up Plan

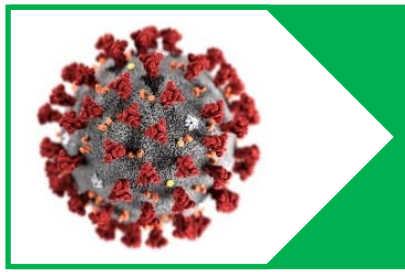
	2 weeks	6 weeks	3 months	6 months
ECG	All	All	All	All
Echo	All	All	Only if persistent coronary involvement at 6 weeks	All
MRI			If EVER cardiac dysfunction	TBD if abnormal cardiac MRI findings at 3 months
Stress Test			If at least 8yo and EVER cardiac dysfunction	TBD if abnormal stress test at 3 months

NETEC

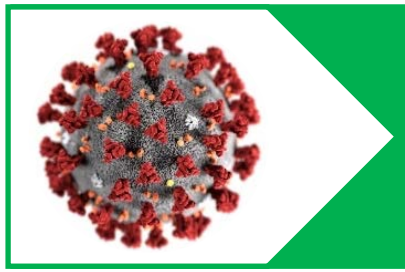
Conclusions



Cardiac involvement during acute COVID-19 infection is not common in children



Heart involvement is VERY common in MIS-C



Follow-up varies by type of infection and degree of heart involvement

Questions and Answers

NETEC Resources

Amanda Grindle, MSN, RN

Resources: NETEC

NETEC is Here to Help

NETEC will continue to build resources, develop online education, and deliver technical training to meet the needs of our partners

Ask for help!

- Send questions to **info@netec.org** - they will be answered by NETEC SMEs
- Submit a Technical Assistance request at **NETEC.org**

Contact

NETEC

NETEC eLearning Center	NETEC Skill videos
courses.netec.org	youtube.com/thenetec

Join the Conversation!

@theNETEC

@the_NETEC

Use hashtag: **#NETEC**

Website	Repository	Email
netec.org	repository.netecweb.org	info@netec.org

NETEC