The Impact of SARS CoV2 on Children and Adolescents
Disclosures

» I have no financial disclosures to make.
Objectives

» Understand the burden of SARS CoV2 infection in our childhood population
» Understand Risk Factors for severe disease
» Understand MIS-C presentation and treatment
» Return to Play guidelines for children who have had Covid or MIS-C
» Understand the psychological impact of children during the pandemic
SARS CoV 2 in children/adolescents

» The burden is broad reaching across physical, emotional, and mental
  ~ Less severe initial disease
  ~ MIS-C
  ~ School performance
  ~ Athletics/activity
  ~ Psychological impact

» Fortunately the physical burden of disease has been lower in children/adolescents than our population >65

» Long term ramifications of the psychological and school burden are yet to be known
State Reporting Varies

- Format/content/metrics differ by state
- Definition of child differs
- Some states changed definitions partway through pandemic
- Unknown # of children infected and not tested / counted
Overall Burden of Disease – 2/25/21

» 3,168,274 total child COVID-19 cases reported with children representing 13.1% of all cases
  ~ Poor early testing availability, suboptimal currently in some areas
  ~ Poor testing ability <2 yr if not hospitalized
» Overall rate: 4,209 cases per 100,000 children in the population
» Children were 1.3%-3.0% of total reported hospitalizations, and between 0.1%-2.2% of all child COVID-19 cases resulted in hospitalization
» Children were < 0.2% of all COVID-19 deaths, and 10 states reported zero child death
North American PICU data

3092 COVID-19 Positive
90 Confirmed Deaths
34K Tested*
942 MIS-C Diagnosed
17K PICU Days
185 Sites Submitted Data*

3/14/20 – 2/25/21
Age Distribution

- 18 to < 30 yrs: 0K (10.79%)
- < 2 yrs 0K: 15.02%
- 2 to < 12 yrs 1K: 32.08%
- 12 to < 18 yrs: 1K (39.54%)

Therapies Used (as Cumulative PICU Days) *

- NIV 1834 (18%)
- ECMO 418 (4%)
- HFNC 2124 (21%)
- HFOV 112 (1%)

COVID-19 Positive PICU Admissions Per Day

- May 2020: 18
- Jul 2020: 17
- Sep 2020: 22
- Nov 2020: 20
- Jan 2021: 17

LOMA LINDA UNIVERSITY CHILDREN’S HEALTH
Risk for severe disease

» Obesity is independently a risk
  ~ Study in the Journal of Pediatrics showed odds ratio of 3.39

» Amount of hypoxia on arrival
  ~ Odds ratio of 4.01

» Age >12 yrs

» Underlying co-morbid conditions
  ~ Chronic Lung disease
  ~ Diabetes
  ~ Congenital Cardiac Disease
  ~ Immunosuppression
  ~ Genetic/Metabolic disease
Comorbidity of Patients

- Normal 1K (40.81%)
- Mod/Severe 1K (35.54%)
- Mild 1K (23.65%)

Average of LOS (in days) by Prior Comorbidities

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<thead>
<tr>
<th>Comorbidity</th>
<th>Average of LOS</th>
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<tr>
<td>Mild</td>
<td>5</td>
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<tr>
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Average of LOS (in days) by Age Group

- >= 30 yrs: 9.4 days
- 18 - < 30 yrs: 7.3 days
- < 2 yrs: 5.6 days
- 12 - < 18 yrs: 5.4 days
- 2 - < 12 yrs: 4.9 days
Presenting Symptoms in Children

» Broad and many organ systems
» ICU level care needed - increased respiratory and cardiac disease
» Ward level care symptoms are variable
» Asymptomatic children presented for many other hospital needs
Is there a blood type correlation?

» Some international data was published in adults to say that O+ was protective. Harvard study did not replicate this but showed that maybe people with O had less severe disease.

» PICU data in North America does not show that but there were a large number of patients with unknown blood type.
ED treatment - Bamlanivimab

Criteria:
~ a. Patient will be discharged from the ED
~ b. Does not require supplemental oxygen or an increase in baseline oxygen use
~ c. Symptom onset is less than 10 days, and

PEDIATRIC PATIENTS - d. high risk with one of the following:
~ i. Is 12-17 years of age and weighs at least 40kg, AND
~ ii. BMI > 85th percentile for age and gender (CDC growth chart), or
~ iii. Sickle cell disease
~ iv. Congenital or acquired heart disease, or
~ v. Neurodevelopmental disorders (e.g. cerebral palsy)
~ vi. Medical-related technological dependence, (e.g. trach, gastrostomy tube, etc.,) or
~ viii. Asthma, reactive airway disease or other chronic respiratory disease requiring daily medication for control.
COVID treatment - Hospital

» Infection prevention and control measures with supportive care

» Indications for experimental treatment
  ~ Symptomatic with LRTI + SARS CoV2 PCR +
  ~ Mod to Severe disease

» Remdesivir - binds to viral RNA dependent RNA polymerase
  ~ loading dose and then up to 10 days
  ~ FDA approved >12 kg and >40 kg
  ~ EUA: 3.5 kg to 40 kg or <12 years and at least 3.5 kg
  ~ Need normal GFR, trend liver function, PT/PTT

» Corticosteroids – mod to severe disease - up to 10 days

» Treat secondary infections, cardiac support, pulmonary support
MIS-C

- Multisystem Inflammatory Syndrome – Children
- < 21 yrs with clinical criteria
  - Fever
  - Illness requiring hospitalization
  - Multisystem organ involvement
  - Lab evidence of inflammation
  - Lab or epi evidence of SARS CoV2 infection
- No alternative plausible diagnosis
- Ave age: 8 years
- General onset: 2-4 weeks after initial SARS CoV2 infection
  - Usually Ab positive, can be PCR + or –
MIS-C

» Cytokine release is felt to be mechanism of severe disease
» Elevated levels of IL-6, IL-1, and TNF may be involved but currently no evidence that inhibiting these improves outcomes
  ~ Several clinical trials underway
» First line therapy
  ~ IVIG 2gm/kg
  ~ + Methylprednisolone 2mg/kg/d x 5 d then oral taper x 2-3 wks
  ~ + low dose asa 3-5 mg/kg/dose daily (max 81mg) x 4-6 weeks
» Refractory therapy
  ~ Methylprednisolone for secondary hemophagocytic lymphohistiocytosis
  ~ Anakinra – 8mg/kg/dose SQ daily x 5 days
LLUCH MIS-C experience

» MIS-C Absent – patients ID was consulted on for symptoms in the MIS-C categories ultimately decided not to be MIS-C

» MIS-C present – those diagnosed as MIS-C
LL MIS-C experience – PE findings

- Abdominal Pain
- Adenopathy
- Altered Mental Status
- Conjunctival Injection
- Diarrhea
- Extremity Changes
- Fever
- Headache
- Nausea/Vomiting
- Oral Changes
- Rash
- Respiratory Distress
- Shock

Percentage of Patients

MIS-C Present/Absent

MIS-C Absent  MIS-C Present
MIS-C
Systems by % at presentation
» Scatter pattern is broad

» Patients all presented with s/s concerning for MIS-C

» No healthy controls in this data set
Return to Play

» ~ 35-45 mil youth from 6-18 participate in athletics
» Recognition that return to play has physical and psychological benefits
» Transition Mitigation Strategies
  ~ Adolescents may spread as easily as adults
  ~ Youth under 10 may spread less
» Prolonged close contact is the #1 driver for spread
» Risk/benefit ratio includes type of sport, local incidence, individual risk
» Masking to/from field/court, during warm up, breaks, all coaches
» Consider pods of athletes, own water bottles, not shared locker rooms, etc
When to return after COVID-19?

» AAP recommends that a PCP clears any youth who had Covid-19 or MIS-C before resuming training.

» Screen for cardiac symptoms
  ~ Chest Pain, SOB, Fatigue, Palpitations, Syncope

» Severe illness – hypotension, arrhythmias, intubation, EMCO, cardiac or renal involvement, MIS-C
  ~ Restrict for 3-6 months
  ~ Gradual return to play with monitoring

» Mild illness/asymptomatic
  ~ Rest 14 days after positive test
  ~ Gradual return to play with obs of symptoms
Myocarditis

» American College of Cardiology’s Sports and Exercise Cardiology Council published in *JAMA Cardiology*, May 2020

» 15% had evidence of myocarditis on CMR imaging

» Acute cardiac injury occur in up to 22% of hospitalized patients with COVID-19, compared with the approximately 1% prevalence in non–COVID-19 acute viral infections.

» Increases the risk of arrhythmias and sudden death
Gradual return to play?

» Onus will fall on strength and conditioning coaches, ATs, monitoring devices to assist.

» Youth <15 or in non-club sports have less access to such resources

» Adolescents are more likely to underreport new symptoms in their desire to play

» Need to discuss risk with families and players
School Return

» <10% of US Covid cases are 5-17 yrs old
» Data to date – in person school has not been associated with substantial community spread
» Critical to control disease spread in community for safe school opening
» Study at University of Mississippi – Pub Jan 2021
   ~ Children/Adolescents were more likely to have known positive contact that was family or close friend
   ~ Were more likely to state that they were not consistent with masking/social distancing in the 14 days prior
» School safety plan
   ~ Should include ventilation and filtration
School Outbreaks

» Can occur if mitigation strategies are not adhered to
» Studies show that they are lower than or equal to community outbreaks if mitigation strategies are adhered to
» North Carolina – 11 districts – adhered to mitigation practices – open fall 2020 with minimal school related transmission
» Chicago, Germany, Norway, Italy – all with data to support that opening with mitigation policies can be done
» Isreal – 2 asymptomatic students lead to outbreak
  ~ They lifted the mask requirement due to heat
School - UK experience

» Closed on March 20, 2020, other than for vulnerable pupils and children of key workers, and national exams were cancelled

» Recognized that vulnerable are less likely to learn well remotely

» Partial opening: 57,600 schools attended by a median of 928,000 students per day. June 1 – July 17
  ~ 113 total cases – most staff, 47% from staff-staff transmission

» Restart March 8

» Students will be tested three times in the first two weeks and then two rapid tests to use each week at home

» Includes family members in the home
Psychological Impact

» Worry about sick parent/grandparent
» Worry about getting sick yourself
» Food or housing insecurity
» Witnessing the anxiety/stress of adult caregivers
» Dealing with the loss of a family member
» Separation from peers
» School challenges – distance learning, loss of monumental milestones (Prom, graduation, senior sports seasons)
» Social Media Bullying
» Home tensions – not all homes are safe places
ACE – Adverse Childhood Event

» Toxic stress – dysregulation of child
» Increased cortisol and proinflammatory cytokines
» Negative health outcomes later in adult life
» The more ACEs experienced -> the greater chance of poor adult outcomes
» Can see physiologic changes in children with delay in cognitive development, somatic complaints, obesity, asthma, diabetes, recurrent infections, sleep disturbance
» Adults who experienced ACEs have increased risk for chronic health problems, substance abuse, mental illness, and earlier death
Studies in the Literature

» Predictability is a stabilizing force for children and adolescents
» Youth are in a critical period of neurodevelopment
» Online questionnaire - 359 children and 3254 adolescents aged 7 to 18 years
  ~ 22.3% of youth had scores indicative of clinical depressive symptoms, (baseline is 13.2% estimated prevalence of youth depression)
  ~ Problem-focused coping style was associated with lower levels of clinical depressive symptoms vs emotion-focused coping style
» PHQ-9 and GAD-7 in >8,000 Jr and Sr High School students
  ~ 43% with depressive symptoms, 37% with anxiety
  ~ Knowledge of prevention measures was greater in those without symptoms
» Bangladesh, Italy, Spain studies all with increased levels of anxiety
  ~ 85.7% of parents reported changes in their children’s emotions and behaviors during the quarantine
» Review of 63 studies: Duration of loneliness compared to intensity of loneliness has been strongly associated with mental health symptoms
» Review of 51 studies: children in all developmental phases have been impacted.
  ~ Age, gender, knowledge, rural/urban, screen time, school closures, family/community connections, pre-existing conditions, covid illness, vulnerable socioeconomic status all have impact in + or - way
Anxiety/Depression/Suicide Risk

» Number of studies have shown increase in mental health stressors
» Rising levels of anxiety and depression
» Concern for rising levels of SI/Suicide attempts – 2\textsuperscript{nd} leading cause of death in adolescents and young adults
  ~ Was on the rise pre-pandemic from 2017 to 2019 – 10\textsuperscript{th} to 2\textsuperscript{nd} cause
» Conflicting reports
  ~ Some reporting an increase in suicide attempts
  ~ Journal of Pediatrics report – scattered elevations but not consistent
» More detailed analysis and continued tracking is key, along with mental health resources
Eating disorders

» Complex relationship with food
» Pre-pandemic was already increasing and skewing younger
» Often stem from attempt to achieve control
» Pandemic has caused food insecurity and panic buying
» Learning from past outbreaks - MERS, Ebola, Influenza
  ~ Sense of foreboding, anxiety, panic, PTSD symptoms
  ~ Relationship between the neuropsychiatric symptoms experienced and the outbreak concerned
Eating Disorders – LL experience

» Difficult to assign causation at this time
» LL Experience is 1.7x the admissions from March 2020 – Now compared to the same time frame the year prior
» 65% of these children have co-existing anxiety or depression
» No major difference in demographics for mean age, gender, race, admission BMI, or comorbidities
» PHP and other services for youth are impacted by pandemic and resources for outpatient therapy is challenging
» Health disparities are seen in programs and types of insurance taken
What can we do

» Talk to our children and adolescents about how they are feeling
» Normalize those feelings without encouraging unhealthy focus on anxiety, sadness, loss of control
» Seek support for yourself or them if symptoms are present
» Encourage PCP visits!
» Advocate at the local, state, national level for safe return to school and activities
» Encourage appropriate families to consider enrolling in clinical vaccine trials
Mental Health Hope

» Coalition of 14 mental health organizations have been meeting regularly since the start of the pandemic

» Created a strategic plan with a road map of 7 policy areas
  ~ Including speeding up the National 988 Suicide Prevention Lifeline
  ~ One of them being integrated “whole person” well-being!

» SAMHSA received $425 mil covid relief and distributed to states

» Barriers – not enough total workforce or diversity in the mental health workforce
Vaccine Hope

» Pfizer – currently 16 and above
  ~ ~2,300 children 12-15 enrolled in trial
  ~ Enroll 5-11 later this year
  ~ 4,000 pregnant women
  ~ Possible new dose, possible new schedule for kids

» Moderna – currently 18 and above
  ~ ~3,000 children 12-17 now

» Johnson & Johnson – currently 18 and above
  ~ Have not started enrollment for children in US
  ~ Planned for 12 - <18, infant trial, pregnant trial
References

References


