

COVID-19 Seminar Series: Pediatric Cases

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Disclosures

- ▶ Nothing to disclose
- ▶ Note: Very little pediatric literature to date, evolving topic; most of the literature has come from China

Objectives:

Discuss COVID-19 from the pediatric perspective:

- ▶ Transmission
- ▶ Clinical Characteristics
- ▶ Infection-Prevention Control Considerations
- ▶ Lab Testing
- ▶ Anti-virals and other medications
- ▶ Supportive Care in Hospital

- ▶ And any other questions you may have along the way

Transmission^{1,2}

- ▶ Droplet: Person-to-person spread when an infected individual coughs, speaks, or sneezes > droplets make contact with mucous membranes (eyes, nose, mouth)
- ▶ Contact: from contaminated surfaces to self (auto-inoculation)
- ▶ Possible airborne transmission?
- ▶ Virus is present in other body fluids (i.e. feces)

- ▶ Limited information about transmission patterns (2-3 published reports)
- ▶ What is available suggests that most transmission occurs within the household
- ▶ Predominantly transmission occurs from infected adults to children
- ▶ The reason for this is not clear... weaker cough? Staying at home more? Receptors?

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

2. Lee, B and Raszka W. COVID-19 Transmission and children: the child is not to blame. Pediatrics 2020; doi: 10.1542/peds.2020-00487

Clinical Characteristics

- ▶ Approximately ~1-2 % of cases will be among children¹
- ▶ Overlap with other common viral respiratory tract infections
- ▶ Symptoms reported among confirmed cases^{1,3}:
 - ▶ Fever (50%), 1-3 days, longest up to 16 days
 - ▶ Cough (42%), mostly non-productive
 - ▶ Pharyngeal redness/congestion (32%)
 - ▶ Shortness of breath (14%)
 - ▶ Rhinorrhea (6%)
 - ▶ Diarrhea, vomiting (5%)
- ▶ Other non-specific s/s: headache, fatigue, myalgia, poor appetite
- ▶ Note: A large proportion of children will be asymptomatic

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

2. Zhen-Dong Y, Gao-Yun Z, and Run-Ming J. Clinical and transmission dynamics characteristics of children with coronavirus disease 2019 in China: A review. *Journal of Infection*. 2020; 11: 55.

Case Categories: Asymptomatic^{1,4}

TABLE 2 Different Severity of Illness by Age Group

Age Group, y ^a	Asymptomatic, n (%)	Mild, n (%)	Moderate, n (%)	Severe, n (%)	Critical, n (%)	Total, n
<1	7 (1.9)	204 (54.2)	125 (33.2)	33 (8.8)	7 (1.9)	376
1–5	15 (3.1)	245 (49.9)	195 (39.7)	34 (6.9)	2 (0.4)	491
6–10	30 (5.8)	277 (53.3)	191 (36.7)	22 (4.2)	0 (0.0)	520
11–15	27 (6.5)	198 (48.1)	170 (41.3)	14 (3.4)	3 (0.7)	412
>15	15 (4.5)	164 (49.1)	145 (43.4)	9 (2.7)	1 (0.3)	334
Total	94 (4.4)	1088 (51.0)	826 (38.7)	112 (5.3)	13 (0.6)	2133

- ▶ Positive nucleic acid test for SARS-CoV-2
- ▶ No signs of symptoms of COVID-19
- ▶ Normal chest imaging
- ▶ Younger age group less likely to be asymptomatic
- ▶ Overall predict this to be ~4.4% of pediatric cases

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

4. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. *Pediatrics* 2020; (6):e20200702

Case Categories: Mild^{1,4}

TABLE 2 Different Severity of Illness by Age Group

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- ▶ Symptoms of upper respiratory tract infection (i.e. cough, sore throat, runny nose etc.) or mild gastrointestinal symptoms (diarrhea, vomiting etc.)³
- ▶ Normal auscultation of chest
- ▶ Largest proportion of patients, around half of all pediatric cases
- ▶ Management considerations: Oral fluids (electrolyte) and fever/pain control?

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

4. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. Pediatrics 2020; (6):e20200702

Case Categories: Moderate^{1,4}

TABLE 2 Different Severity of Illness by Age Group

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<1	7 (1.9)	204 (54.2)	125 (33.2)	33 (8.8)	7 (1.9)	376
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- ▶ Signs/symptoms of pneumonia^{1,3}: coughing (productive and non-productive), fever, possible wheezing
- ▶ Not hypoxic
- ▶ Auscultation of chest abnormal
- ▶ Abnormal chest imaging
- ▶ Second largest group of patients (~40%)
- ▶ Management considerations: Hydration status of child, underlying co-morbid conditions, distance to medical attention, trajectory of illness (getting worse or getting better?)

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

4. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. *Pediatrics* 2020; (6):e20200702

Case Categories: Severe^{1,4}

TABLE 2 Different Severity of Illness by Age Group

Age Group, y ^a	Asymptomatic, <i>n</i> (%)	Mild, <i>n</i> (%)	Moderate, <i>n</i> (%)	Severe, <i>n</i> (%)	Critical, <i>n</i> (%)	Total, <i>n</i>
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- ▶ Respiratory symptoms (fever, cough) +/- gastrointestinal symptoms
- ▶ Central cyanosis and shortness of breath
- ▶ Oxygen saturation < 92%
- ▶ Abnormal chest imaging
- ▶ Highest proportion in the youngest age groups

- ▶ Management considerations: in-patient admission, more details to come...

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

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Case Categories: Critical^{1,4}

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- ▶ Acute respiratory distress syndrome, respiratory failure
- ▶ Other possible manifestations: shock, end-organ failure (acute kidney injury, encephalopathy etc.)
- ▶ Abnormal chest imaging
- ▶ Highest proportion in the youngest age group

- ▶ Management considerations: in-patient admission, more details to come...

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

4. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. Pediatrics 2020; (6):e20200702

Multisystem Inflammatory Syndrome in Children: “MIS-C”

Case definition:

- ▶ Age \leq 21 yo
- ▶ Fever
- ▶ Lab evidence of inflammation (CRP, ESR, ferritin, LDH etc.)
- ▶ Need for hospitalization for severe illness and \geq end organ systems involved
- ▶ No other alternative diagnosis
- ▶ Positive for SARS-CoV-2 infection OR exposure to confirmed or suspected COVID-19 case within the previous four weeks
- ▶ ****Can look similar to and fulfill criteria for Kawasaki Disease****

Infection Prevention Control

- ▶ Safest assumption is that everyone is infected = Standard Precautions
- ▶ Overall Goals:
 - ▶ Quick diagnosis of those who are infected- appropriate triage and isolation
 - ▶ Protection of healthcare workers
- ▶ Children will need a caregiver to accompany them, always assume both are infected (safest)
- ▶ If possible both the child and the caregiver should be masked
 - ▶ Limitations: young age, altered mental status, PPE availability
- ▶ Patients often don't realize they're sick, do not be falsely reassured by them
- ▶ If a sick patient needs to come into your facility, try to limit movement and contact prevent nosocomial spread
 - ▶ Ward and room restrictions
 - ▶ Limit number of personnel contacts in contact with this group

1. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html>, Accessed June 15/2020

4. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. Pediatrics 2020; (6):e20200702

Laboratory Testing for COVID-19

- ▶ Basic labs
- ▶ SARS-CoV-2/COVID-19 specific testing:
 - ▶ RT-PCR
 - ▶ Point of Care Testing (POCT)
 - ▶ Serology

Basic Labs

- ▶ CBC, electrolytes, renal function all appropriate for more sick patients
- ▶ May observe lymphopenia/leukopenia, mild hepatitis, elevated inflammatory markers:
 - ▶ None are specific to COVID-19 (can be seen in many different viral processes)

SARS-CoV-2 RT-PCR

- ▶ Several different genes from SARS-CoV-2 to target; all targets very similar sensitivity and specificity
- ▶ So what IS the sensitivity/specificity of these tests?
- ▶ It depends on:
 - ▶ quality of specimen
 - ▶ NP vs throat vs LRT
 - ▶ When specimen is taken in disease course
 - ▶ Community prevalence of COVID-19
- ▶ Ideally, Sensitivity 95-99%, Specificity 99-100%

Does RT-PCR positivity predict SARS-CoV-2 infectivity?

- ▶ Positivity does not equal infectivity!
- ▶ Viral transmission is unlikely beyond 8-10 days of symptoms in mild to moderate disease; may be longer in more severe disease
- ▶ Ct value from RT-PCR may help predict infectious SARS-CoV-2:
 - ▶ Ct values >24 are increasingly less likely to represent infectiousness

1. Wölfel *et al.* Virological assessment of hospitalized patients with COVID-19. Nature [published online April 1, 2020]. Available from: <https://doi.org/10.1038/s41586-020-2196-x>.
2. He *et al.* Temporal dynamics in viral shedding and transmissibility of COVID-19. Nature Medicine [published online April 15, 2020]. Available from: <https://doi.org/10.1038/s41591-020-0869-5>.
3. Bullard *et al.* Predicting infectious SARS-CoV-2 from diagnostic samples. Clinical Infectious Diseases [published online May 22, 2020], ciaa638, <https://doi.org/10.1093/cid/ciaa638>.

SARS-CoV-2 POCT



Key points of COVID-19 POCT

Pros:

- ▶ Excellent performance when compared to laboratory developed tests (LDTs) and commercial assays
- ▶ Excellent turnaround time (results in under an hour)
- ▶ Dead sexy looking!

Cons:

- ▶ Typically more expensive
- ▶ Considered low throughput

Serology

- ▶ All target a few key SARS-CoV-2 viral proteins
- ▶ Some viral proteins predict neutralization (Spike/S protein) better than others (Nucleocapsid/N protein)
- ▶ Many options through the FDA!!
- ▶ Fairly good specificity (~80-100%)
- ▶ Sensitivity varies by timing symptom onset:
 - ▶ 3-7 days: ~25-50%
 - ▶ 8-14 days: ~50-80%
 - ▶ >14 days: ~65-90%

Important points about SARS-CoV-2 serology

What it's likely good for:

- ▶ Seroprevalence studies
- ▶ MIS-C

What it's likely **NOT** good for:

- ▶ Predicting immunity
- ▶ Acute clinical diagnostics

Treatment Options

- ▶ Supportive care will be the normal for almost all cases of COVID-19 in children!
 - ▶ Mild/moderate disease (no oxygen required)
- ▶ Antivirals rarely recommended but can be determined on a case-by-case basis in those with confirmed virological COVID-19 AND if enrolled in a clinical trial
 - ▶ Severe/Critical (oxygen required +/- mechanical ventilation support)
- ▶ Suggest use of remdesivir (targets RdRP) if available
- ▶ Lopinavir-Ritonavir (Kaletra)
- ▶ Please don't use hydroxychloroquine...