SARS-CoV-2 Point Prevalence among Asymptomatic Hospitalized Children and Subsequent Healthcare Worker Evaluation

Ami B. Patel MD MPH,[1,2] Andrea Clifford RN BSN,[1] Julie Creaden MSN APRN CPNP-PC,[1] Kimberly Kato RN BSN MS,[1] Marcelo R. Malakooti MD,[1,2] William J. Muller MD PhD,[1,2] Anna O'Donnell MSN RN CIC,[1] Sally Reynolds MD,[1,2] Karen Richey DNP MBA RN NEA-BC,[1] Jason Rippe JD,[1] Derek S. Wheeler MD MBA,[1,2] Larry K. Kociolek MD MSCI[1,2]

[1]Ann & Robert H. Lurie Children's Hospital of Chicago
[2] Northwestern University Feinberg School of Medicine, Chicago IL

Corresponding Author
Ami B. Patel, MD MPH
Division of Pediatric Infectious Diseases
Ann & Robert H. Lurie Children's Hospital of Chicago
225 E. Chicago Ave, Box 20
Chicago, Illinois 60611
Email: abpatel@luriechildrens.org
Phone: (312) 227-4080

Alternate Author
Larry K. Kociolek, MD MSCI
Division of Pediatric Infectious Diseases
Ann & Robert H. Lurie Children's Hospital of Chicago
225 E. Chicago Ave, Box 20
Chicago, Illinois 60611
Email: lkociolek@luriechildrens.org
Phone: (708) 932-4593

Abstract:

Asymptomatic SARS-CoV-2 carriage among hospitalized children and the risk of transmission to healthcare workers (HCW) was evaluated through a point prevalence survey. We estimated a low, 1-2%, prevalence of SARS-CoV-2 among children without symptoms of COVID-19 and there were no secondary transmission events among HCW exposed to these patients.

Key words: SARS-CoV-2, COVID-19, asymptomatic, healthcare worker, children

Asymptomatic SARS-CoV-2 carriage has been reported during the COVID-19 pandemic[1,2], but prevalence data are lacking, especially in hospitalized children. The risk of transmission[3] from asymptomatic children remains unknown. We conducted a point prevalence survey for SARS-CoV-2 among hospitalized children around the time of predicted peak community COVID-19 activity in Chicago. Our objectives were to characterize: 1) prevalence of SARS-CoV-2 in hospitalized children without symptoms of COVID-19; 2) the frequency of secondary infection among healthcare workers (HCW) exposed to asymptomatic children with SARS-CoV-2; and 3) environmental contamination in rooms of asymptomatic children with COVID-19.

Methods

Ann & Robert H. Lurie Children's Hospital of Chicago is a 364-bed free-standing academically affiliated children's hospital. All inpatient children were offered testing for SARS-CoV-2 over a 2-day period, regardless of clinical concern for COVID-19 in these patients. On day 1, children in the intensive care units (ICU) were tested. On day 2, children in acute care units were tested. All inpatient children were included with the following exceptions: children known to be SARS-CoV-2-positive; children tested within the previous 72 hours because of clinical suspicion for COVID-19 and were SARS-CoV-2-negative; contraindications to obtaining a nasopharyngeal sample; or parents declined participation. Two nurses per unit obtained all specimens on their unit. Nurses participated in an orientation and sample collection competency session to review optimal nasopharyngeal specimen collection. Each child had one nasopharyngeal specimen collected sampling both nares via one synthetic fiber flocked swab. The swabs were stored in viral transport media at room temperature until processed by the laboratory within 12 hours of collection.

An exposure workup was conducted for all HCW who had significant contact with any patient who tested positive for SARS-CoV-2 on our point prevalence. A significant exposure was considered as being within 6 feet of the patient for at least 10 minutes without appropriate personal protective equipment (PPE). For patients who tested positive for SARS-CoV-2, appropriate PPE would have been a standard facemask, eye protection, gown and gloves for routine care and N95 (instead of standard facemask) if an aerosol generating procedure was performed. Universal masking for HCW and visitors with a Level 1 procedure facemask provided by the hospital was ongoing at the time of this study. Family members were asked to wear a Level 1procedure mask provided by the hospital when HCW entered patient rooms, but patients were not masked in their inpatient room. Of note, universal eye protection for HCW was not in place at the time of this survey so although masks were required at all times for HCW, eye protection was not.

To evaluate contamination of hospital rooms of children with COVID-19, we sampled the environment of children identified on this point prevalence survey as well as the inpatient rooms of known COVID-19 positive children for comparison. Samples were collected with pre-moistened synthetic fiber flocked swabs with viral transport media.

Samples were analyzed in a CLIA-certified laboratory using a qualitative FDA-approved RT-PCR assay (Abbott RealTime™ SARS-CoV-2, Abbott Molecular Inc., Illinois). This assay is intended for detection of nucleic acids from the SARS-CoV-2 virus from individuals suspected of COVID-19 by their healthcare provider and was applied identically to both symptomatic and asymptomatic patients. Environmental samples were processed similarly to nasopharyngeal swab samples for the purpose of this study, however environmental sampling is not validated for this assay.

Results

Point Prevalence and Clinical Characteristics

We performed SARS-CoV-2 RT-PCR on nasopharyngeal swabs collected from 148/197 hospitalized children (97 ICU and 51 acute care unit) after a median (interquartile range) length of stay of 33 (6-73) days. We excluded 49/197 inpatients because: clinically suspected COVID-19 but tested negative in the prior 72 hours (n=35); known COVID-19 positive (n=2); parental declination (n=10); and medical contraindication (n=2). Table 1 summarizes clinical characteristics. Only 2/148 (1.4%; 95% confidence interval 0.4-4.8%) patients, both on acute care units, tested positive.

Child 1, tested on day 2 of a 2-day hospital stay, is a school-aged child with an endocrinopathy who was admitted from the emergency department after one episode of emesis thought to be related to the child's underlying condition. This child was under contact isolation (gowns, gloves) because of the emesis. Upon further history, the child had mild sore throat the day prior to admission but had resolved by the day of admission. This child had no known ill household contacts..

Child 2, tested on day 4 of a 4-day hospital stay, is a school-aged child with leukemia who was admitted for chemotherapy. This child was not on isolation. The child had a respiratory illness about one month prior. SARS-CoV-2 testing was not performed at that time, but respiratory viral PCR panel was positive for rhinovirus/enterovirus. Other household members also had a respiratory illness at that time but were not tested for SARS-CoV-2. At the time of the point prevalence study, the child's symptoms had significantly improved; only a very mild lingering cough was present. The child underwent an aerosol generating procedure (intubation for procedural anesthesia) two days prior to testing.

Healthcare Worker Surveillance

We identified 68 HCWs with significant exposure (being within 6 feet of the patient for at least 10 minutes during the child's admission) to at least one of the children, 18 related to Child 1 and 50 related to Child 2 (HCW roles listed in Supplemental Table 1). HCWs were actively monitored for COVID-19 symptoms for 14 days post exposure. Additionally, 28 (41%) and 40 (59%) HCWs agreed to SARS-CoV-2 RT-PCR testing between days 5-7 and day 10-14 after exposure, respectively. Four HCWs who developed respiratory symptoms, and the asymptomatic HCWs who agreed to testing, all tested negative for SARS-CoV-2. This included six HCWs exposed to the child during an aerosol generating procedure; all 6 remained asymptomatic and 5/6 agreed to testing and were negative. Thus, we did not identify any secondary transmission events related to the two children with COVID-19 identified by point prevalence.

Environmental Sampling

Seventeen total environmental samples were collected from high-touch surfaces in rooms of patients identified with COVID-19 by point prevalence survey. For Child 1, ten samples were collected at the time of result notification prior to any room cleaning. The child had been admitted for about 30 hours. For Child 2, seven samples were collected at the time of result notification, which was 6 hours after patient was discharged and after the room had undergone a routine discharge clean with a quaternary ammonia disinfectant. (surfaces samples are listed in Supplemental Table 2). All swabs from these patients identified by point prevalence survey were negative for SARS-CoV-2. For comparison, we swabbed ten high-touch surfaces (same surfaces as Child 1) from each of the rooms of the 2 known COVID-19-positive patients admitted at the time of the point prevalence survey, and only one sample from each room detected SARS-CoV-2 (bed rails in room 1 and nurse call button remote in room 2).

Discussion

In summary, we estimated SARS-CoV-2 point prevalence among hospitalized children without clinical suspicion of COVID-19 to be very low, approximately 1-2%, when performed around the time of predicted peak community COVID-19 activity. There was no detection of SARS-CoV-2 environmental contamination of inpatient rooms of these children and there were no secondary transmission events among HCW exposed to these patients. This suggests the infection control and occupational health implications for care of these children with undetected SARS-CoV-2 shedding were minimal to HCWs who were universally masked.

Limitations to asymptomatic detection include point-prevalence design and duration of hospital stay. Many children had relatively long length of stays (i.e., >14 days), often beyond the SARS-CoV-2 incubation period related to community exposure. However, we received anecdotal reports from staff that parents sometimes circumvented visitation policies (i.e., not completing or omitting details from their daily symptom screening, not wearing their universal mask while in the inpatient room), so children may remain at risk of SARS-CoV-2 exposure even while hospitalized. Lack of compliance with daily symptom screening and universal masking by HCW has not been observed. There was a small number of asymptomatic positive patients limiting a broader evaluation of HCW exposures and transmission. In addition, although all HCW were monitored for symptoms, not all agreed to testing. Environmental sampling was limited by lack of a standard protocol for test collection and lack of validation of our hospital SARS-CoV-2 PCR assay for this purpose. Although this surveillance was limited to the inpatient setting of one children's hospital, these data may guide isolation precautions and testing strategies during this pandemic.

References

1. Hu Z, Song C, Xu C, et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. Sci China Life Sci 2020;63:706-11.
2. Bai Y, Yao L, Wei T, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020;323(14):1406-7.
3. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. N Engl J Med 2020;382(10);970-71.

Table 1: Clinical characteristics and inpatient hospital location of 148 children tested for SARS-CoV-2 point prevalence

Demographics			
Median age (IQR)	10m (2m-10 years)		
Male sex – no. (%)	85 (57%)		
Median (IQR) hospital LOS at time of SARS-CoV-2 testing	33 days (IQR 6-73)		
Comorbidities – no. (%)			
Asthma	4 (3%)		
Cancer/blood disorder	13 (9%)		
	47 (32%)		
Chronic lung disease	55 (37%)		
Cardiac disease	25 (17%)		
Immunosuppression	15 (10%)		
Neurological disorder	9 (6%)		
Organ failure			
Hospital Unit	**no. (%)**	**Median age (IQR)**	**Median (IQR) LOS, days**
Acute care unit	38 (26%)		
	13 (9%)	7y (1-14y)	8 (1-33)
Oncology/stem cell transplant unit	18 (12%)	15y (5-18y)	8 (3-41)
	45 (30%)	10y (10m-14y)	47 (15-96)

Pediatric ICU	34 (23%)	2m (1m-5m)	37 (14-84)
Neonatal ICU		8m (2m-3y)	61 (15-129)
Cardiac ICU			

m- months, y – years, no – number, IQR- interquartile range, LOS- length of stay, ICU- intensive care unit