

Characteristics of Hospitalized Pediatric COVID-19 Cases — Chicago, Illinois, March – April 2020

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Keywords:

1. COVID-19
2. Epidemiology
3. Hospitalization
4. Comorbidities
5. Co-infections

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Summary (<40 words):

The first U.S. urban jurisdiction case series summarizing findings of enhanced case investigation of hospitalized pediatric COVID-19 patients. Epidemiologic and clinical characteristics described; household transmission was frequent, and all hospitalized patients were found to have an underlying comorbidity or co-infection.

Abstract

Background

To date, no report on COVID-19 pediatric patients in a large urban center with data on underlying comorbidities and co-infection for hospitalized cases has been published.

Methods

Case series of Chicago COVID-19 patients aged 0-17 years reported to Chicago Department of Public Health (CDPH) from 3/5/20–4/8/20. Enhanced case investigation performed. Chi-square and Wilcoxon two-sample tests to compare characteristics among hospitalized and non-hospitalized cases.

Results

During March 5–April 8, 2020, 6369 lab-confirmed cases of COVID-19 were reported to CDPH; 64 (1.0%) were among children 0-17 years. Ten patients (16%) were hospitalized, seven (70%) required intensive care (ICU); median length of hospitalization 4 days (range: 1–14). Reported fever and dyspnea were significantly higher in hospitalized patients compared to non-hospitalized patients (9/10 vs. 28/54, $p = 0.04$ and 7/10 vs. 10/54, $p = 0.002$, respectively). Hospitalized patients were significantly younger than non-hospitalized patients (median, 3.5 years vs. 12 years; $p = 0.03$) and all either had an underlying comorbidity or co-infection. Among the 34 unique households with multiple laboratory-confirmed infections, median number of laboratory-confirmed infections was 2 (range: 2–5), and 31 (91%) households had at least one COVID-19 infected adult. For 15 households with available data to assess transmission, 11 (73%) were adult-to-child, 2 (13%) child-to-child, and 2 (13%) child-to-adult.

Conclusions

Enhanced case investigation of hospitalized patients revealed that underlying comorbidities and co-infection might have contributed to severe disease. Given frequency of household transmission, healthcare providers should consider alternative dispositional planning for affected families of children living with comorbidities.

Original Article

Background:

On March 12, 2020, the Chicago Department of Public Health (CDPH) received its first report of a pediatric patient with laboratory-confirmed coronavirus disease 2019 (COVID-19). In the month that followed, a total of 64 pediatric cases (children aged 0–17 years) were reported through April 8, 2020. Most affected children had mild or moderate illness and did not require hospitalization. However, some children with underlying comorbidities or those diagnosed with co-infections had severe manifestations requiring hospitalization. Symptomology of children with COVID-19 throughout the United States has been described (1); however, to date no report on pediatric patients in a large urban center with data on underlying comorbidities and co-infection for the most severe cases has been published. This report characterizes the clinical and epidemiological characteristics of COVID-19 in Chicago children in the first month of known community transmission.

Methods

Data were submitted on laboratory-confirmed COVID-19 cases into the Illinois' National Electronic Disease Surveillance System (I-NEDSS). Additionally, results of COVID-19 laboratory tests were reported to I-NEDSS and deduplicated by person to determine the percent of Chicago residents who tested positive for COVID-19. Standard case investigation data were collected including demographic characteristics, signs and symptoms of illness, hospitalization (e.g., date of admission, intensive care unit [ICU] requirement) and epidemiologic risk factors such as exposures to ill persons, travel, and comorbidities. If routine case investigation was not completed for a patient, a team consisting of a senior epidemiologist and physician investigator

performed phone interviews with families to complete the investigation. If families could not be reached, medical records were requested and chart abstraction was completed. For hospitalized patients, enhanced data collection confirmed length of hospitalization, laboratory evidence of co-infection, and clarification of underlying diagnoses. Additional household members with a laboratory-confirmed infection were identified via interviews as well as provider and laboratory reports in I-NEDSS. Within a household, transmission was determined to be adult-to-child if the adult's reported onset date was prior to the child's; transmission from child-to-adult and child-to-child were similarly assessed. If onset dates were the same, or the household reported a common exposure, such as travel or attending an event having reports of COVID-19, household transmission was not assessed. Chi-square and Wilcoxon two-sample tests were performed to compare demographic characteristics and reported symptoms among hospitalized and non-hospitalized cases.

Results

During March 5–April 8, 2020, 6369 lab-confirmed cases of COVID-19 were reported to CDPH; 64 (1.0%) were among children <18 years (Figure 1). Testing volume and positivity increased for both children and adults over the study period. The percent of those tested who were positive ranged from 0%–18.4% for children aged 0–17 years and 7.4%–32.7% for adults \geq 18 years. Overall pediatric positivity during this time was 110/1045 (10.5%). The median age of pediatric patients with COVID-19 during this time was 11 years (interquartile range: 7–16 years) (Table). Twenty-nine (45%) cases were among children aged 14–17 years and 15 (23%) among children aged 0–4 years; eight (13%) were among infants 0–11 months. Males accounted for 56% of patients. Race and ethnicity of patients aligned with Chicago demographics overall (2); 34% were Black, non-Hispanic; 39% White, non-Hispanic; 25% Hispanic; and 6% Asian.

Of 50 (78%) patients with comorbidity data available, 13 (26%) had one or more pre-existing conditions including five (10%) with chronic lung disease (i.e., asthma or reactive airway disease), three (6%) with cardiac or congenital heart disease, two (4%) with Trisomy 21, two (4%) with immunocompromising conditions, two (4%) with atopy, and one (2%) with a history of prematurity.

Among all 64 patients, cough was the most commonly reported symptom in 48 (75%) patients, fever was present in 36 (56%), with remaining symptoms presented in the Table. Three (5%) patients denied any symptoms. Ten patients (16%) were hospitalized (Figure 2). The median length of hospitalization was 4 days (range: 1–14) for the nine patients who had been discharged at the time of this report (Figure 2). Reported presence of fever and dyspnea were significantly higher in hospitalized patients compared to non-hospitalized patients (9/10 vs. 28/54, $p = 0.04$ and 7/10 vs. 10/54, $p = 0.002$, respectively). Hospitalized patients were also significantly younger than non-hospitalized patients (median, 3.5 years vs. 12 years; $p = 0.03$). Of those hospitalized, all either had an underlying comorbidity or co-infection detected. Three (30%) had a history of chronic lung disease, two (20%) had a history of cardiac or congenital heart disease, two (20%) had Trisomy 21, and two (20%) had immunodeficiency (one with immune dysfunction related to a genetic disorder; one with recent myelosuppressive chemotherapy). Four (40%) hospitalized patients had known co-infections: one with elevated *Mycoplasma pneumoniae* IgM; one with positive nasopharyngeal adenovirus polymerase chain reaction (PCR); one with positive nasopharyngeal human rhinovirus/enterovirus PCR, positive nasopharyngeal adenovirus PCR, and *Escherichia coli* urinary tract infection; and one with positive rotavirus stool antigen.

Of 10 hospitalized patients, seven (70%) required ICU. Of these, four (57%) had at least one underlying comorbidity (Figure 2). Two (50%) had a history of cardiac or congenital heart disease, one (25%) had a history of chronic lung disease, two (50%) had Trisomy 21, and one (25%) had immunodeficiency. All four patients with co-infections required ICU. One patient that required ICU had an underlying condition and co-infection. Infants (aged 0–11 months) represented four (40%) hospitalized children and four (57%) ICU patients. No COVID-19 related pediatric deaths were reported in this cohort.

Among 27 (42%) patients with known travel history, two (7%) reported travel to New York City within the 14 days prior to symptom onset. Forty (63%) had at least one additional household member with laboratory-confirmed COVID-19. Among the 34 unique households with multiple laboratory-confirmed infections, the median number of laboratory-confirmed infections was 2 (range: 2–5), and 31 (91%) households had at least one adult who also had a laboratory-confirmed infection. For 15 households for which all necessary data to determine transmission were available, 11 (73%) were adult-to-child, 2 (13%) were child-to-child, and 2 (13%) were child-to-adult. None of the 64 pediatric patients were associated with a recognized outbreak in a congregate setting.

Conclusions

Studies on COVID-19 in children from China reported mild disease and variable clinical presentation [3,4]. In a recent report on 2572 U.S. pediatric patients with COVID-19, complete data on characteristics were limited due to preliminary nature of data collection from local health departments [1]. Completion and reliability of characteristics such as symptoms (100%), preexisting underlying medical conditions (78%) and hospitalization status (100%) was

improved in the Chicago cohort compared to 9.4%, 13% and 33% respectively in the national cohort [1]. For 25 of 50 patients, underlying medical conditions were based solely upon I-NEDSS reporting data, however, all comorbidity data for hospitalized patients were confirmed with chart review and discussions with relevant staff at treating hospitals. While national pediatric clinical presentations were similar in the smaller Chicago cohort, the addition of information on comorbidities and co-infection in hospitalized children is instructive to focus public health efforts on shielding children at higher risk of complications from household transmission. Review of medical records and family interview revealed a higher ICU hospitalization rate (11%) compared to upper estimate of national pediatric data (2%) [1]. The discrepancy might be related to incomplete reporting in the national dataset or lack of case investigation.

Upon review of testing volume across the city, infants represented 17.5% (183/1044) of all Chicago children who were known to be tested during this time period and 13% of all pediatric patients, similar to national data (15%) [1]. In the Chicago cohort, infants accounted for 40% of all hospitalizations and 57% of ICU hospitalizations and many were found to have underlying comorbidities or co-infection supporting a heightened risk perception for this group of infants or suggesting that risk perception plays a role in hospitalization. Data on pediatric co-infection with SARS-CoV-2 are scant in the literature. A recent research letter [5] revealed co-infection in 24 of 116 (21%) specimens positive for SARS-CoV-2; the youngest patient in the SARS-CoV-2 co-infection group was aged 9 years. While patients with co-infections did not differ significantly in age from those infected with SARS-CoV-2 only (mean age 46.9 years vs. 51.1 years, 4.2-year difference [95% CI, -4.8 to 13.2]), no specific pediatric data on co-infection and disease severity were presented.

Enhanced case investigation of all hospitalized revealed that, as with infants, underlying comorbidities and co-infection might have contributed to severe disease. Of concern was the finding that the majority of cases (63%) had multiple persons with confirmed COVID-19 living at home. Considering that school closures and shelter-in-place directives were instituted during this time period, multiple lab-confirmed infections within a household suggest household transmission was more likely than community transmission for pediatric patients. Healthcare providers and public health systems should consider increased collaboration to support alternative dispositional planning for affected individuals living with children and adults with comorbidities. While the broad recommendation to shelter-in-place has slowed the spread of infection, shielding children with underlying cardiac and pulmonary comorbidities may be indicated. Additionally, guidance to reduce transmission in the home should continue to be reinforced with all persons who are confirmed or suspected to have COVID-19.

Collection of reliable past medical history, details on disease course, and epidemiologic exposures related to transmission will continue to inform public health policy regarding resuming pediatric congregate activities as containment strategies reemerge as primary prevention during the deceleration phase of the COVID-19 pandemic. In order to reduce burden on healthcare providers, public health systems should explore automatic electronic health record transfer of variables related to hospital course, currently in process through a recent CDPH public health order, to facilitate continued public health impact.

Word count: 1599

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TABLE. Characteristics of children aged ≤17 years with laboratory confirmed COVID-19 (N=64) — Chicago, Illinois, March–April 2020

Characteristics	No. (%)
Age, median, years [IQR]	11 [7–16]
Age groups	
0–4 years	15 (23)
5–9 years	11 (17)
10–13 years	10 (16)
14–17 years	29 (45)
Gender	
Female	28 (44)
Male	36 (56)
Race/Ethnicity	
Hispanic	16 (25)
Black, non-Hispanic	20 (31)
White, non-Hispanic	22 (34)
Asian, non-Hispanic	3 (5)
Other, non-Hispanic	2 (3)
Unknown	1 (2)
Exposure/risk history	
Travel outside Illinois*	2 (7)
Lab-confirmed case in household member	40 (63)
Underlying comorbidity†	13 (26)
Symptoms	
Cough	48 (75)
Nasal congestion/rhinorrhea/anosmia	19 (30)
Sore throat	16 (25)
Dyspnea§	17 (27)
Fever	36 (56)
Headache	18 (28)
Myalgia	15 (23)
Chills	5 (8)
Abdominal pain	8 (13)
Diarrhea	10 (16)
Nausea/vomiting	4 (6)
Disease severity	
Hospitalized	10 (16)
Hospitalized in ICU¶	7 (70)
Underlying comorbidity¶**	7 (70)
Co-infection¶††	4 (40)

*Among those with supplementary data available (N = 27). Travel was reported to New York City (2).

†Among those with comorbidity data available (N = 50).

§Includes shortness of breath, increased work of breathing, wheezing, chest pain.

¶Among those hospitalized (N = 10).

**Some patients had multiple underlying comorbidities, which included atopy (1), cardiac or congenital heart disease (2), chronic lung disease (3), Trisomy 21 (2), and immunocompromising condition (2).

††Co-infections included adenovirus, *Escherichia coli* urinary tract infection, *Mycoplasma pneumoniae*, human rhinovirus/enterovirus, and rotavirus.

Figure 1: Number of lab-confirmed COVID-19 cases among children ≤ 17 years ($n = 64$) by age, hospitalization status, and specimen collection date – Chicago, Illinois, March – April 2020

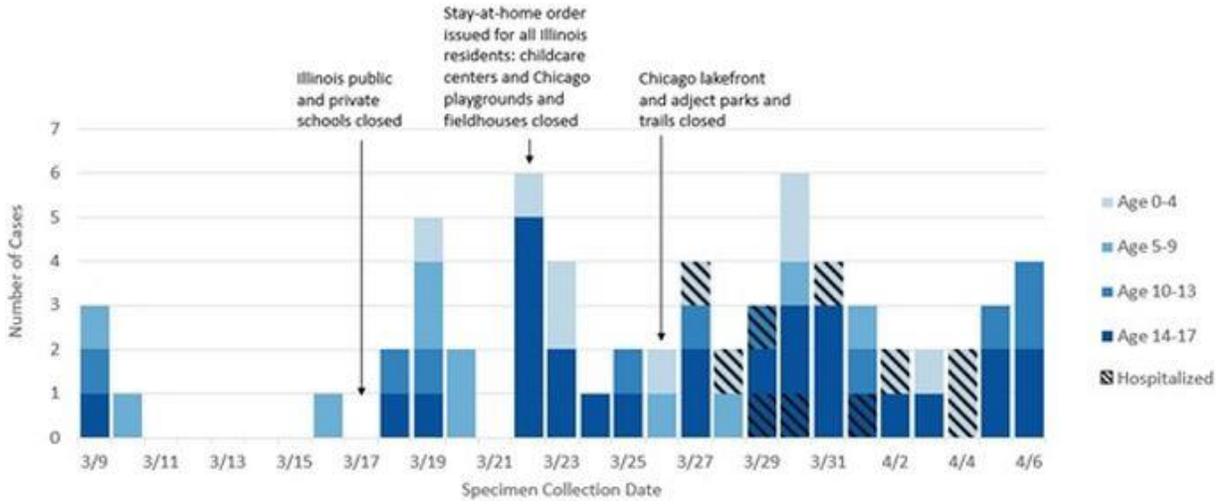
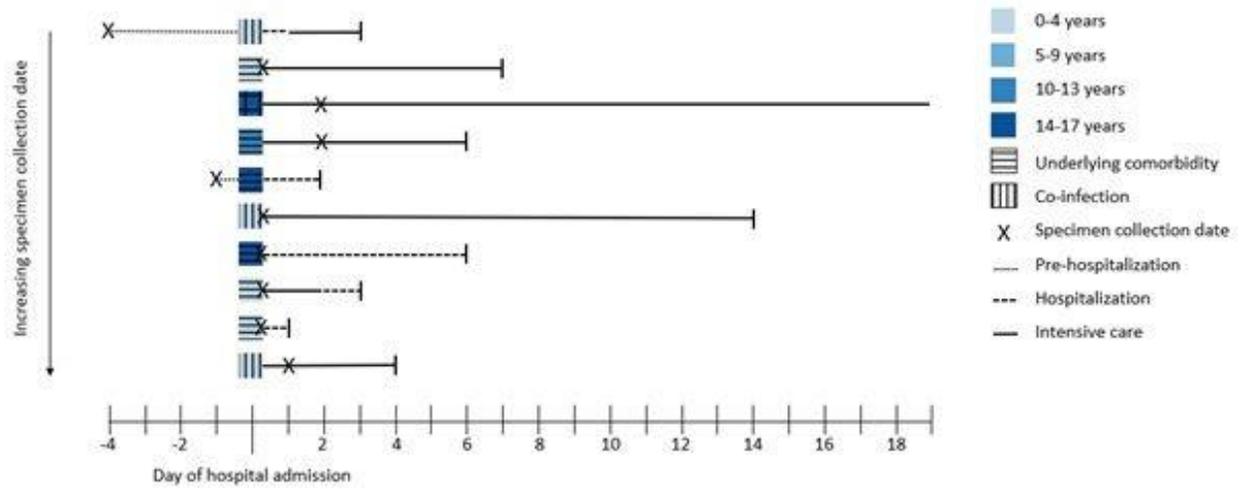


Figure 2: Hospitalization stay* among lab-confirmed COVID-19 cases ≤ 17 years (N = 10) by age, underlying comorbidity, and co-infection – Chicago, Illinois, March – April 2020



*One case is still hospitalized at the time of this report