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BRIEF REPORT

Severe Acute Respiratory Syndrome Coronavirus 2 Infections in Children: Multicenter Surveillance, United States, January–March 2020

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Previous reports of coronavirus disease 2019 among children in the United States have been based on health jurisdiction reporting. We performed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing on children enrolled in active, prospective, multicenter surveillance during January–March 2020. Among 3187 children, only 4 (0.1%) SARS-CoV-2–positive cases were identified March 20–31 despite evidence of rising community circulation.

Key words. acute respiratory illness; COVID-19; pediatrics; public health surveillance.

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As of May 24, 2020, coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), had resulted in 1 622 114 reported cases and 97 049 deaths in the United States (US) [1]. Previous US reports of COVID-19 among children relied on clinician-ordered testing and health jurisdiction reporting to the Centers for Disease Control and Prevention (CDC) [2, 3]; we present preliminary SARS-CoV-2 data collected during active surveillance of pediatric acute respiratory illness (ARI) through CDC's New Vaccine Surveillance Network (NVSN) January–March 2020.

METHODS

NVSN's active, prospective, population-based ARI surveillance among children aged <18 years was reestablished in 2015 and is conducted at 7 US pediatric medical centers (Table 1) [4, 5]. Children presenting with ≥1 ARI symptom and/or fever were eligible for enrollment in inpatient, emergency department (ED), or outpatient clinic settings, as were asymptomatic controls presenting for well-child visits. Enrollment criteria by clinical setting with full list of eligible symptoms and age ranges are described in Table 1. Institutional review board approvals were obtained at CDC and at each institution; prior to enrollment, parental informed consent was obtained for parent/guardian interview, medical record review, and respiratory specimen collection with approval for storage and future testing for respiratory pathogens.

Each site performed retrospective SARS-CoV-2 testing on respiratory specimens from children who were enrolled and had specimens collected beginning either January 1 or February 1 and extending through March 31, 2020 (Table 1). Although eligible children are routinely identified ≥5 days/week in the inpatient setting, ≥4 days/week in the ED, and 1–5 days/week in the outpatient clinic, enrollment activities were paused or limited during March at all sites because of limitations to patient access instituted during the pandemic (eg, institutional suspensions of surveillance activities, laboratory supply, and/or personal protective equipment shortages). Suspension of enrollment occurred at the following sites by clinical setting and date: Cincinnati (inpatient March 25–30, ED March 24–30, outpatient and control March 25); Seattle (outpatient March 2–12, control March 13–31); Houston (inpatient, ED, outpatient, and control March 23–31); Kansas City (inpatient March 18–29, ED March 18–28, outpatient and control March 18–31); Pittsburgh (inpatient and ED March 22–29, outpatient and control March 13–31).

Specimens were tested using validated real-time reverse-transcription polymerase chain reaction (RT-PCR) assays based on CDC primers and probes [6]. Positive Seattle-site specimens

Table 1. Severe Acute Respiratory Syndrome Coronavirus 2 Test Results in the New Vaccine Surveillance Network, by Site and Clinical Setting, January–March 2020

		Clinical Setting									
		Inpatient[b]		Emergency Department[b]		Outpatient Clinic[c]		Asymptomatic Controls[d]		All	
Site	Specimen Collection Date Range[a]	Age Range Tested, y	no./No. (%) Positive	Age Range Tested, y	no./No. (%) Positive	Age Range Tested, y	no./No. (%) Positive	Age Range Tested, y	no./No. (%) Positive	Age Range Tested, y	no./No. (%) Positive
Rochester, NY	1/2/20–3/30/20	0–17	0/173 (0)	0–17	0/164 (0)	0–1	0/22 (0)	0–4	0/11 (0)	0–17	0/370 (0)
Pittsburgh, PA	1/2/20–3/20/20	0–17	0/436 (0)	0–5	0/238 (0)	0–1	0/63 (0)	0–4	0/21 (0)	0–17	0/758 (0)
Cincinnati, OH	2/1/20–3/31/20	0–17	1/94 (1.1)	0–16	0/152 (0)	0–1	0/27 (0)	0–3	0/29 (0)	0–17	1/302 (0.3)
Nashville, TN	2/2/20–3/30/20	0–17	0/126 (0)	0–17	0/171 (0)	0–1	0/61 (0)	0–4	0/44 (0)	0–17	0/402 (0)
Kansas City, MO	2/3/20–3/31/20	0–15	0/52 (0)	0–16	0/186 (0)	0–1	0/19 (0)	0–4	0/7 (0)	0–15	0/264 (0)
Houston, TX	1/2/20–3/22/20	0–17	0/291 (0)	0–15	0/130 (0)	0–1	0/121 (0)	0–4	0/62 (0)	0–17	0/604 (0)
Seattle, WA	1/1/20–3/31/20	0–16	1/199 (0.5)	0–8	2/205 (1.0)	0–1	0/72 (0)	0–4	0/11 (0)	0–16	3/487 (0.6)
All sites	1/1/20–3/31/20	0–17	2/1371 (0.1)	0–17	2/1246 (0.2)	0–1	0/385 (0)	0–4	0/185 (0)	0–17	4/3187 (0.1)

Abbreviations: MO, Missouri; NY, New York; OH, Ohio; PA, Pennsylvania; TN, Tennessee; TX, Texas; WA, Washington.

[a]Dates are presented as month/day/year. Enrollment was paused or limited during March because of limitations to patient access instituted during the pandemic (eg, institutional suspensions of surveillance activities, laboratory supply, and/or personal protective equipment shortages).

[b]Children aged <18 years were eligible for enrollment if they resided in the center's surveillance area and visited the emergency department (ED) or were admitted to the hospital in the 48 hours preceding enrollment with ≥1 of the following presenting symptoms/events: fever, cough, earache, nasal congestion, runny nose, sore throat, vomiting after coughing, wheezing, shortness of breath/rapid or shallow breathing, apnea, apparent life-threatening event or brief resolved unexplained event, or myalgias; and the duration of illness that led to the hospitalization/visit was <14 days. Children were excluded if they had a known nonrespiratory cause for the hospitalization/visit, had fever and neutropenia from chemotherapy, had been transferred from another hospital after admission of >48 hours, were admitted <5 days of a previous hospitalization, had never been discharged home after birth, or had previous enrollment in the study <14 days prior to current admission/visit.

[c]Children aged <24 months were eligible for enrollment if they resided in the center's surveillance area and presented to clinic with ≥1 of the following symptoms/events: fever, cough, earache, nasal congestion, runny nose, sore throat, wheezing, or shortness of breath/rapid or shallow breathing; and the duration of illness that led to the visit was <14 days. Children were excluded if they had a known nonrespiratory cause for the outpatient visit, had fever and neutropenia from chemotherapy, were seen at the clinic within 5 days after an acute respiratory illness hospitalization/ED visit, or had been enrolled as outpatients within the previous 4 days.

[d]Children were eligible for enrollment as asymptomatic controls if they were aged >14 days to <5 years, resided in the center's surveillance area, and were evaluated at a routine (eg, well-child) outpatient visit with no cough, earache, fever, nasal congestion, runny nose, shortness of breath/rapid or shallow breathing, sore throat, vomiting after cough, or wheezing on the day of visit or 3 days preceding the visit, and no diarrhea or vomiting on the day of visit or 14 days preceding the visit. In addition, children were excluded if they were immunocompromised, had been previously enrolled as a healthy control in the same season, or had a sibling enrolled during the same visit.

were retested with a second RT-PCR assay and considered inconclusive if the second test was not positive [7]; when possible, inconclusive specimens were retested a third time using the CDC-based RT-PCR assay to yield a final result. Preliminary clinical and demographic data were used in descriptive analyses. To document SARS-CoV-2 circulation in surveillance areas, weekly numbers of COVID-19 cases for all ages reported from counties in which most NVSN enrollees reside were analyzed for January 1–April 4, 2020 [8].

RESULTS

During the surveillance period, 3261 of 5573 (59%) eligible children were enrolled; among 2312 nonenrolled children, most common reasons for nonenrollment included declination (64%), patient discharge before consent could be obtained (11%), and parent/guardian unavailability (10%). Among enrolled children, 3187 (98%) had adequate specimens collected and tested, which included combined midturbinate nasal and oropharyngeal swabs (58%), midturbinate nasal swabs (35%), nasopharyngeal swabs (3%), nasal wash (2%), oropharyngeal swab (<1%), and tracheal aspirate (<1%); specimen type information was unavailable at the time of preliminary analyses in 1%. Children tested included 1371 (43%) hospitalized, 1246 (39%) ED, 385 (12%) outpatient, and 185 (6%) asymptomatic control subjects (Table 1). Median age of all 3187 children tested was 19 months (range, 0–17 years); 1085 (34%) were aged <1 year.

Four (0.1%) children had SARS-CoV-2 detected by RT-PCR methods; 1 (<0.1%) specimen was inconclusive. All 4 positive children had ARI (2 hospitalized and 2 ED patients); no asymptomatic controls tested positive. Three cases were detected in Seattle (specimens collected March 20–26), and 1 was detected in Cincinnati (March 31) (Figure 1). The median age of SARS-CoV-2–positive children was 6 months (range, 1–12 months); 2 were male. Most frequent symptoms included fever, cough, nasal congestion/runny nose, and fussiness/irritability (n = 3 each). No case patient had underlying comorbidities. Neither hospitalized patient required supplemental oxygen or intensive care, and both were discharged after 1 day.

Health jurisdictions reported 7815 COVID-19 cases from surveillance counties during January 1–April 4, 2020 (Figure 1) [8]. NVSN detections in Seattle and Cincinnati each occurred after surrounding counties had reported COVID-19 cases: The first reported US COVID-19 case was in an adult in the Seattle area on January 22, with community spread occurring in late February, while the first reported case from Hamilton County, Ohio, was on March 19 (Figure 1) [7, 8]. Other NVSN site counties reported their first community cases during March 5–18.

DISCUSSION

Few pediatric SARS-CoV-2–positive cases were detected through systematic surveillance during January–March, despite evidence of rising circulation in the surrounding communities in March. Four (0.1%) COVID-19 cases, all in ≤12-month-old

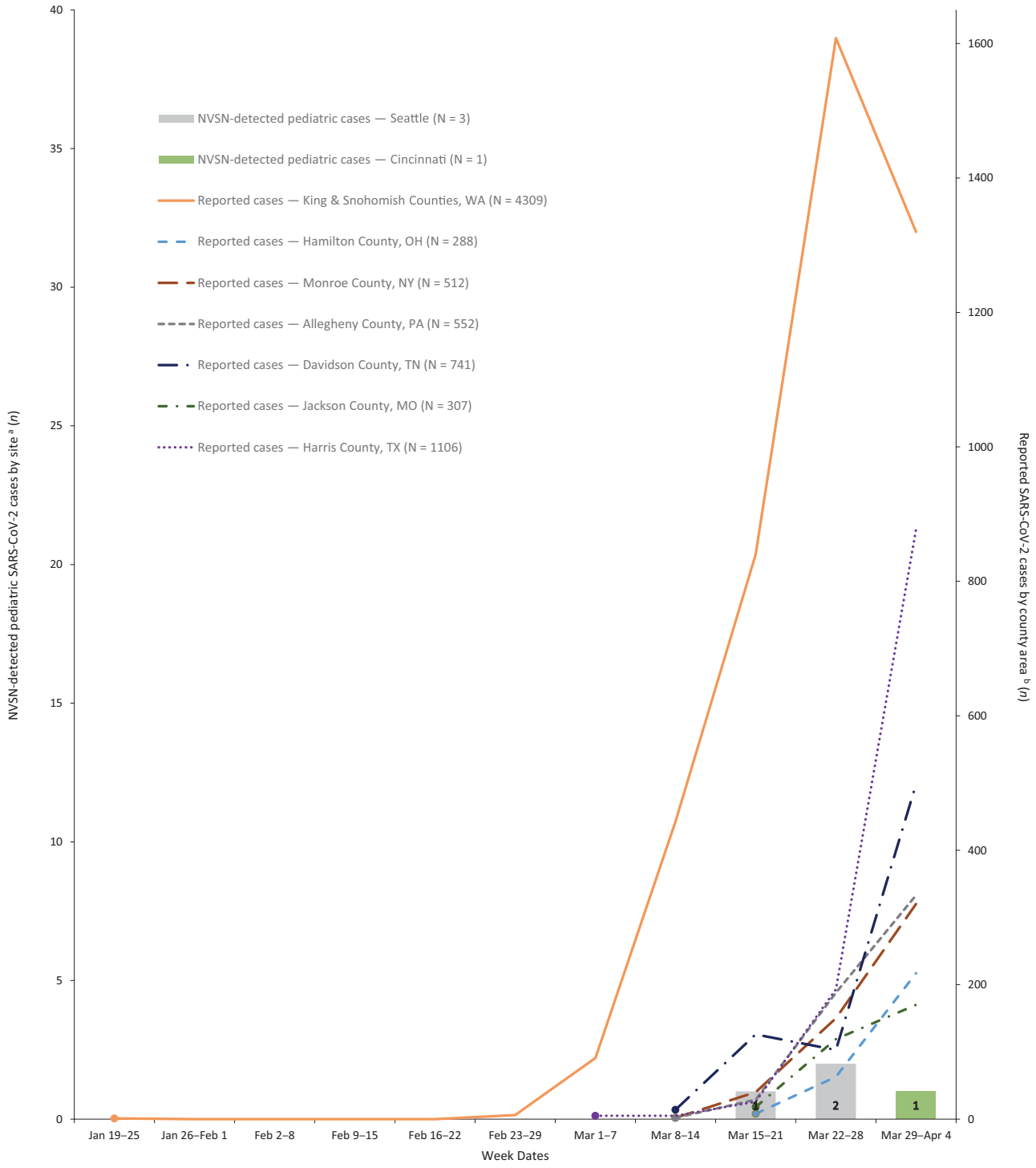

Figure 1. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) cases detected by the New Vaccine Surveillance Network (NVSN) by site among children <18 years of age and weekly health jurisdiction reports of cases by main surveillance counties among all ages [8]. [a]Includes test-positive specimens collected during January 1–March 31. [b]Includes cases reported by the weeks of January 19–25 through March 29–April 4 [8]. The majority of patients tested at each site resided in these county areas. Earliest reports of cases by county area (date): King and Snohomish counties, Washington (January 22); Harris County, Texas (March 5); Davidson County, Tennessee (March 8); Monroe County, New York (March 12); Allegheny County, Pennsylvania (March 14); Jackson County, Missouri (March 18); Hamilton County, Ohio (March 19). Abbreviations: MO, Missouri; NY, New York; OH, Ohio; PA, Pennsylvania; TN, Tennessee; TX, Texas; WA, Washington.

children presenting with ARI, were identified March 20–31. Three were from the Seattle area, which reported the first US COVID-19 case [8, 9].

These low numbers are consistent with previous US reports showing children constitute a small minority of reported COVID-19 cases [2, 3]. From February 12 to April 2, only 1.7%

of cases reported to CDC by local US jurisdictions occurred in children, though 22% of the US population is <18 years old [2]. In addition, although surveillance testing was performed on specimens collected from children enrolled as early as January or February, all 4 COVID-19 cases were detected in late March, which may reflect that community transmission was limited earlier in the year, consistent with other findings from US surveillance [8, 10].

Study limitations include possible missed detections because only 59% of eligible children were enrolled, lack of enrollment of older children in outpatient settings, and suspended or limited surveillance due to pandemic-related restrictions during March while community circulation appeared to be rising. Testing algorithms were not standardized across sites, and each site validated and conducted its own testing. Differences in test performance by site (including the possibility of false-positive results) were not evaluated.

Strengths of this surveillance included broad inclusion criteria and testing not reliant on clinical testing practices, which revealed that >99% of children tested at the 7 sites from January–March were SARS-CoV-2 negative. As US cases increase, continued surveillance is needed to elucidate COVID-19 epidemiology in children.

Notes

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All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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