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

Brian Rha
Joana Y. Lively
Janet A. Englund
Mary A. Staat
Geoffrey A. Weinberg

See next page for additional authors

Follow this and additional works at: https://scholarlyexchange.childrensmercy.org/papers

Part of the Infectious Disease Commons, and the Pediatrics Commons

Recommended Citation
Creator(s)
Brian Rha, Joana Y. Lively, Janet A. Englund, Mary A. Staat, Geoffrey A. Weinberg, Rangaraj Selvarangan, Natasha B. Halasa, John V. Williams, Julie A. Boom, Leila C. Sahni, Marian G. Michaels, Laura S. Stewart, Christopher J. Harrison, Peter G. Szilagyi, Monica M. McNeal, Eileen J. Klein, Bonnie Strelitz, Kirsten Lacombe, Elizabeth Schlaudecker, Mary Moffatt, Jennifer E. Schuster, Barbara A. Pahud, Gina Weddle, Robert W. Hickey, Vasanthi Avadhanula, Mary E. Wikswo, Aron J. Hall, Aaron T. Curns, Susan I. Gerber, and Gayle Langley

This article is available at SHARE @ Children's Mercy: https://scholarlyexchange.childrensmercy.org/papers/2697
Severe Acute Respiratory Syndrome Coronavirus 2 Infections in Children: Multicenter Surveillance, United States, January–March 2020

Brian Rha,1 Joana Y. Lively,1,2 Janet A. English,1 Mary A. Staat,4 Geoffrey A. Weinberg,5 Rangaraj Selvarangan,6 Natasha B. Halasa,7 John V. Williams,8 Julie A. Boom,8 Leila C. Salini,7 Marian G. Michaels,7 Laura S. Stewart,1 Christopher J. Harrison,1 Peter G. Szilagyi,1 Monica M. McNeal,1 Eileen J. Klein,1 Bonnie Strelitz,1 Kirsten Lacombe,1 Elizabeth Schlaudecker,1 Mary E. Moffatt,6 Jennifer E. Schuster,6 Barbara A. Pahud,4 Gina Weddle,6 Robert W. Hickey,4 Vasanthi Avadhanula,3 Mary E. Wikswo,1 Aron J. Hall,1 Aaron T. Curns,1 Susan I. Gerber,1 and Gayle Langley1

1COVID-19 Response Team, Centers for Disease Control and Prevention, Atlanta, Georgia, USA; 2IHRC Inc, contracting agency to the Division of Viral Diseases, Atlanta, Georgia, USA; 3Seattle Children's Hospital, Seattle, Washington, USA; 4Department of Pediatrics, University of Cincinnati, Cincinnati, Ohio, USA; 5University of Rochester School of Medicine and Dentistry, Rochester, New York, USA; 6University of Missouri–Kansas City School of Medicine, Children's Mercy, Kansas City, Missouri, USA; 7Vanderbilt University Medical Center, Nashville, Tennessee, USA; 8UPMC Children's Hospital of Pittsburgh, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA; 9Texas Children's Hospital, Houston, Texas, USA; 10Department of Pediatrics, Baylor College of Medicine, Houston, Texas, USA; and 11Department of Molecular Virology and Microbiology, Baylor College of Medicine, Houston, Texas, USA

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
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
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

Acknowledgments. We thank the children and parents who participated in this study. We also thank all members of the New Vaccine Surveillance Network, including Monika Johnson, Samar Musa, Noreen Jeffrey, Sara Walters, and Amy Kiziler at the UPMC Children's Hospital of Pittsburgh, Marilyn Rice, Nicole Meyer, Chelsea Rohlfis, Amy Singh, Sahle Amsalu, Amy Ostrow, Monica Asman, Christina Quigley, Kristyn Brundidge, Joshua Adams, Maureen Carolin, Krista Doerfllein, Carley Dunkman, Nicholas Leahy, Allison McCauley, Katie Santanello, Meghan Sweeney, and Tricia Williams at Cincinnati Children's Hospital Medical Center; as well as Mary Ann Kirkconnell Hall at the Centers for Disease Control and Prevention.

Disclaimer. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Financial support. This work was supported by the US Centers for Disease Control and Prevention (cooperative agreement number CDC-RFA-IP16-004).

Potential conflicts of interest. J. A. E. is a consultant for Sanofi Pasteur and Meissa Vaccines. J. V. W. serves on the Scientific Advisory Board of Quidel and an independent data monitoring committee for GlaxoSmithKline, neither with any relationship to the present work. N. B. H. receives grant funding, vaccine donation, and hemagglutination inhibition assay testing from Sanofi, grant funding from Quidel, and is a consultant for Karius. C. J. H.'s institute receives grant funding for pediatric vaccine studies from GSK, Merck, and Pfizer, and for in vitro antimicrobial studies from Merck, none with any relationship to the present work. B. A. P. has been an investigator on clinical trials funded by GlaxoSmithKline and Allos Biopharma/Janssen, and received honoraria from Merck, GlaxoSmithKline, Allos Biopharma/Janssen, Pfizer, Sequiris and Sanofi Pasteur for service on advisory boards and for non-branded presentations, none with any relationship to the present work. All other authors: No reported conflicts of interest.

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.

References


