Journal of Adolescent Health 69 (2021) 144–148

JOURNAL OF
ADOLESCENT
HEALTH

www.jahonline.org

Adolescent health brief

Severe Acute Respiratory Syndrome Coronavirus 2 Testing Trends Among Persons Aged <18 Years in an Outpatient Pediatric Practice — Metropolitan Atlanta, Georgia, May–December 2020

Maureen J. Miller, M.D., M.P.H. [a,b,*], Sharoda Dasgupta, Ph.D., M.P.H. [b], Jasmine Ruffin, M.P.H. [b,c], Kevin Colton, M.D. [d], David King, M.D. [d], Jacqueline E. Tate, Ph.D., M.S.P.H [b], Hannah L. Kirking, M.D. [b], Bobbi Bryant, M.P.H. [b,e], Nora Hennesy, M.P.H. [b], Zuwena Plata, M.P.H. [b], Jasmine Y. Nakayama, Ph.D. [a,b], Mary R. Tanner, M.D. [b], Aybüke Koyuncu, M.P.H. [b], and Elizabeth Rabold, M.D., M.P.H. [b]

[a] *Epidemic Intelligence Service, Centers for Disease Control and Prevention, Atlanta, Georgia*
[b] *CDC COVID-19 Response Team, Centers for Disease Control and Prevention, Atlanta, Georgia*
[c] *ABT Associates, Atlanta, Georgia*
[d] *Children's Medical Group, Atlanta, Georgia*
[e] *General Dynamics Information Technology, Atlanta, Georgia*

Article history: Received February 2, 2021; Accepted April 13, 2021
Keywords: Coronavirus; COVID-19; Adolescents; Children

A B S T R A C T

Purpose: The purpose of this study was to analyze trends in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing and test positivity among persons aged <18 years in a three-site outpatient pediatric practice in Atlanta, Georgia, serving approximately 35,000 pediatric patients.
Methods: Using electronic medical records, weekly trends in SARS-CoV-2 tests performed and the 14-day moving average of test positivity were examined, overall and by age group, during May 24–December 5, 2020.
Results: Among 4,995 patients who received at least 1 SARS-CoV-2 test, 6,813 total tests were completed. Overall test positivity was 5.4% and was higher among older pediatric patients (<5 years: 3.3%; 5–11 years: 4.1%; 12–17 years: 8.6%). The number of tests and test positivity increased after holidays and school breaks.
Conclusions: Families might benefit from communication focused on reducing SARS-CoV-2 transmission during holidays. In addition, given higher test positivity in children aged 12–17 years, tailoring public health messaging to older adolescents could help limit SARS-CoV-2 transmission risk in this population.

IMPLICATIONS AND CONTRIBUTION

In light of the higher SARS-CoV-2 test positivity and increasing autonomy in older children, families might benefit from communication focused on reducing SARS-CoV-2 transmission during holidays and special occasions. COVID-19 communication tailored to adolescents might be a useful component of public health.

In 2020, more than 2.5 million children in the United States tested positive for the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, which causes COVID-19 (*1*). Children account for 1%–3% of all hospitalizations and up to .1% of all COVID-19–related deaths [1]. Transmission potential among children may be similar to that among adults [2]; however, nearly one-third of children infected with SARS-CoV-2 are

Conflicts of interest: The authors have no conflicts of interest to disclose.
Disclaimer: The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

* Address correspondence to: Maureen J. Miller, M.D., M.P.H., Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop US1-1 Atlanta, Georgia 30329-4027.
E-mail address: yax6@cdc.gov (M.J. Miller).

https://doi.org/10.1016/j.jadohealth.2021.04.010

asymptomatic [3]. COVID-19 incidence data in children are incomplete, and testing is more frequently carried out by persons who feel sick or suspect they may have been exposed to the virus. We sought to add to the knowledge of COVID-19 incidence in children by evaluating electronic medical records from Pediatric Medical Group A (practice A), a large pediatric clinic with three locations in metropolitan Atlanta, Georgia, that serves approximately 35,000 active outpatients aged $<$ 18 years.

Methods

Using electronic medical records from practice A, weekly trends in SARS-CoV-2 tests performed and percentage of persons who tested positive (test positivity) were examined during May 24–December 5, 2020. Practice A conducted SARS-CoV-2 testing with Bako RT-PCR as a send-out test from May to mid-June 2020 and with Sofia SARS Antigen Fluorescent Immunoassay/Quidel as a point-of-care test from mid-June 2020 onwards. For patients aged 0–17 years who had ≥1 clinical encounter during May 24–December 5, 2020 that included SARS-CoV-2 testing, demographic information, date of encounter, and test results were abstracted from the electronic medical records. Encounters were excluded if no test was performed, test results were not recorded, or only SARS-CoV-2 antibody test (without antigen or polymerase chain reaction [PCR] testing) was performed.

Among children who had encounters during the analysis period, overall number of tests and SARS-CoV-2 test positivity were examined at the person level and encounter level. For the person-level analysis, age was assigned using first date of positive SARS-CoV-2 test or first test date for all others. Mantel-Haenszel chi-square tests or Fisher's exact test was used to examine differences in SARS-CoV-2 test positivity in different groups by age, sex, and race/ethnicity ($p < .05$). Trends in SARS-CoV-2 test volume and positivity were examined by week (we defined "week" as the sum of all SARS-CoV-2 tests performed from Sunday (date listed on Figure) to Saturday. Practice A did not test patients on Sundays during this period.) and stratified by the age group. Test positivity was calculated based on the 14-day moving average to smooth expected variations in testing patterns and daily case counts (Calculating Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Laboratory Test Percent Positivity: CDC Methods and Considerations for Comparisons and Interpretation. We defined test positivity for the person-level analysis using the "people over people" method (number of new people with positive tests divided by the sum of the number of people with positive tests and the number of people with negative tests). We defined test positivity for the encounter-level analysis using the "test over test" method (number of positive tests divided by the sum of the number of positive and negative tests) (Test Positivity Tracking Efforts - Johns Hopkins Coronavirus Resource Center (jhu.edu). In this analysis, 14-day moving averages for number of positive tests and number of total tests performed were calculated separately based on the past 14 days. Each moving average percent positivity value was calculated by dividing these two values.). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy as part of an emergency response (see for example, 45 C.F.R. part 46.102(l) [2], 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.). Analyses were conducted using SAS (SAS Institute; version 9.4) and Microsoft Excel (Microsoft; Office 365 ProPlus) software.

Results

Of all patients with ≥1 encounter with an associated SARS-CoV-2 test during the analysis period (n = 4,995), 31.6% were aged <5 years, 33.8% were aged 5–11 years, and 34.6% were aged 12–17 years (Table 1). Just more than half

Table 1
Patterns in SARS-CoV-2 testing and test positivity[a], overall and by age, sex, and racial and ethnic groups—Pediatric Medical Group A, metropolitan Atlanta, Georgia, May 24–December 5, 2020

	Number of children tested			Number of SARS-CoV-2 tests		
	For SARS-CoV-2					
	Children tested	Children who tested positive	P^b	Total testing encounters	Tests positive	P^b
	N (column %)	N (row %)		No (column %)	N (row %)	
Overall	4,995 (100%)	269 (5.4%)		6,813 (100%)	283 (4.2%)	
Age group			<.001			<.001
<5 years	1,576 (31.6%)	52 (3.3%)		2175 (31.9%)	55 (2.5%)	
5–11 years	1,689 (33.8%)	69 (4.1%)		2184 (32.1%)	70 (3.2%)	
12–17 years	1,730 (34.6%)	148 (8.6%)		2454 (36.0%)	158 (6.4%)	
Sex	 		.1311			.2245
Male	2599 (52.0%)	152 (5.9%)		3539 (51.9%)	157 (4.4%)	
Female	2396 (48.0%)	117 (4.9%)		3274 (48.1%)	126 (3.9%)	
Race/Ethnicity			.9082			.6038
Hispanic	310 (6.2%)	13 (4.2%)		429 (6.3%)	13 (3.0%)	
Asian, non-Hispanic	383 (7.7%)	13 (3.4%)		504 (7.4%)	13 (2.6%)	
Black, non-Hispanic	282 (5.7%)	20 (7.1%)		375 (5.5%)	21 (5.6%)	
White, non-Hispanic	3608 (72.2%)	202 (5.6%)		4,942 (72.5%)	212 (4.3%)	
Other/unknown	412 (8.3%)	21 (5.1%)		563 (8.3%)	24 (4.3%)	

SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

[a] Calculating severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) laboratory test percent positivity: CDC methods and considerations for comparisons and interpretation. We defined test positivity for the person-level analysis using the "people-over-people" method (number of new people with positive tests divided by the sum of the number of people with positive tests and the number of people with negative tests). We defined test positivity for the encounter-level analysis using the "test-over-test" method (number of positive tests divided by the sum of the number of positive and negative tests).

[b] Mantel-Haenszel chi-square tests were used to examine differences in SARS-CoV-2 test positivity between groups for all categories except Primary Language and Insurance, for which Fisher's exact test was used ($p < .05$).

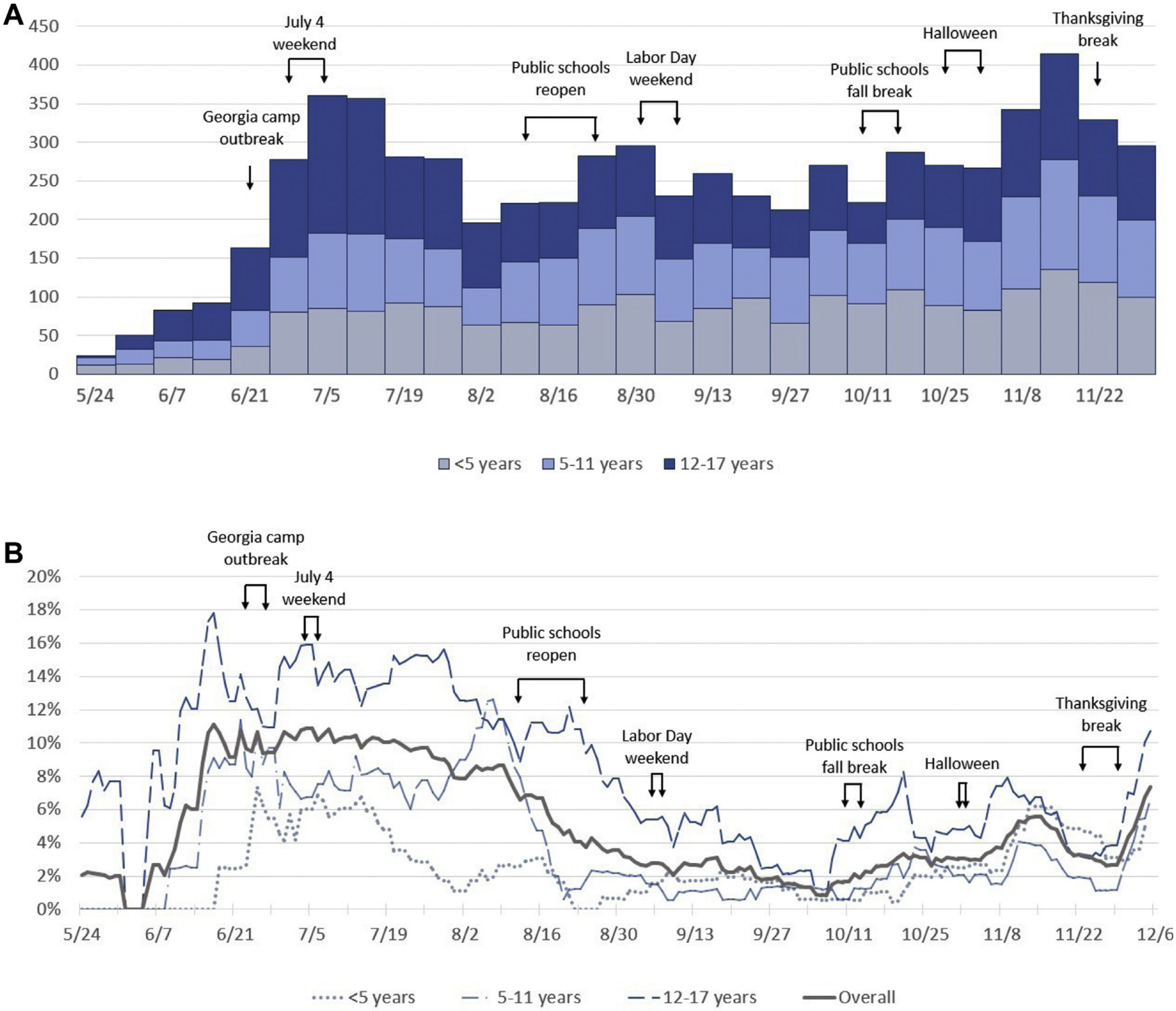

Figure 1. Number of SARS-CoV-2 real-time polymerase chain reaction (RT-PCR) or Sofia SARS Antigen Fluorescent Immunoassay tests (A) and Percent positivity[a] (B), by age group, in children aged <18 years tested for SARS-CoV-2 in Pediatric Medical Group A by week[b]—metropolitan Atlanta, Georgia, May 24–December 5, 2020. "https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/calculating-percent-positivity.html." [a] Calculating severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) laboratory test percent positivity: CDC methods and considerations for comparisons and interpretation. We defined test positivity for the person-level analysis using the "people-over-people" method (number of new people with positive tests divided by the sum of the number of people with positive tests and the number of people with negative tests). We defined test positivity for the encounter-level analysis using the "test-over-test" method (number of positive tests divided by the sum of the number of positive and negative tests). [b] Weekly testing is defined as the sum of all SARS-CoV-2 tests performed from Sunday to Saturday. Pediatric Medical Group A did not test patients on Sundays during this time period. In this analysis, 14-day moving averages for number of positive tests and number of total tests performed were calculated separately based on the past 14 days. Each moving average percent positivity value was calculated by dividing these two values.

of the patients (52.0%) were men. Most patients identified as non-Hispanic white (72.2%). The majority of patients (93.6%) were privately insured. The SARS-CoV-2 test positivity increased significantly ($p < .05$) with increasing age (<5 years: 3.3%; 5–11 years: 4.1%; 12–17 years: 8.6%) but did not vary significantly by sex or racial/ethnic group. Percentage of positive tests at the encounter level (n = 6,813 tests) showed similar findings (Table 1). Tests performed increased from <50 total tests per week in May to >350 tests per week in early July (Figure 1A). Total tests performed decreased during August, peaked in November to >400 tests per week, and spiked after key events, including a COVID-19 outbreak associated with a Georgia camp [4], reopening of metropolitan Atlanta schools, Fall Break, Halloween, and Thanksgiving. After May 31, the overall percentage of positive SARS-CoV-2 tests increased, peaking in July (Figure 1B). Throughout the analysis period, percent positivity was most frequently highest among persons aged 12–17 years.

Discussion

In this outpatient pediatric practice, total tests performed and test positivity rose in the summer months, declined in the early fall, and peaked in the late fall. Although testing volume was similar by the age group, SARS-CoV-2 test positivity was highest among adolescents aged 12–17 years. Test positivity increased after key events, including Halloween and Thanksgiving [1], reflecting test positivity patterns seen in state-level COVID-19 surveillance data [5] and national claims data [6]. In another U.S. region, Hobbs et al. [7] found that children who attended activities without consistent risk mitigation had higher test positivity, highlighting how much remains unknown about how pediatric practitioners used evolving knowledge of infection risk by the age group to inform test ordering.

Practice A used CDC and AAP guidance [8,9] and empirical experience to develop and implement its testing strategy. Many Atlanta area institutions including schools [10] and day care centers required testing before participation. Reentry guidance changed over time, necessitating a flexible testing strategy. Pediatric practitioners worked with local public health personnel to accommodate local considerations, including preactivity screening, exposure status, and symptoms [11,12].

These findings are subject to several limitations. First, available billing data did not provide testing indication (e.g., screening, symptoms, exposure), which might have influenced test positivity. Second, the population of practice A was primarily white, non-Hispanic, and urban. Our findings therefore might not be generalizable to other pediatric populations, and our finding that there were no differences in test positivity by racial or ethnic group had low power. Testing of 16,554 children at Texas Children's Hospital in Houston, a city where 46% of individuals identify as Hispanic or Latino, during this time period found 66% of Hispanic children (42% of all children) had positive tests [13,14]. Third, testing volume and positivity trends might have been influenced by time of year and activity entry requirements. Although the intent of the analysis was to provide descriptive trend data by the age group, future studies should consider how trend analysis methods, including accounting for covariates other than time, might affect the observed patterns. Fourth, practice A did not perform follow-up testing after antigen tests were performed; recent guidance recommends follow-up testing with polymerase chain reaction in certain circumstances to minimize false-positive and false-negative results [15]. Finally, factors not discussed in this report, including local transmission patterns and use of mitigation strategies, may have impacted testing trends and test positivity.

In this practice, SARS-CoV-2 test positivity was highest among the 12- to 17-year age group and increased after holidays and school breaks. This cohort represents about 15% of practice A outpatients (4.5% aged <5 years, 4.8% aged 5–11 years, 4.9% aged 12–17 years), so these findings should be interpreted cautiously, though national trend analyses from this study period also showed higher case incidence in adolescents than in younger children [16]. As communities reopen, and children and adolescents continue to interact through school, recreational activities, and other social gatherings, the COVID-19 pandemic presents unique challenges in navigating and prioritizing social interactions, particularly among adolescents who often exercise independent decision-making [17–19]. Families might benefit from communication focused on reducing SARS-CoV-2 transmission during holidays. In addition to public health messages aimed at adults and caregivers, adolescents might benefit from tailored messaging and outreach strategies that address their developmental stage and social behaviors [20].

Acknowledgments

The authors would like to acknowledge Christine M. Szablewski, D.V.M., Georgia Department of Public Health, and Faisal Saleem, Children's Medical Group of Atlanta, for their contributions to this report.

Funding Source

This research was supported by the U.S. Centers for Disease Control and Prevention.

References

[1] American Academy of Pediatrics. Children and COVID-19: State data report. American Academy of pediatrics and the Children's hospital association. Children and COVID-19: State-Level Data Report. Available at: aap.org. Accessed January 22, 2021.
[2] Grijalva CG, Rolfes MA, Zhu Y, et al. Transmission of SARS-COV-2 infections in Households — Tennessee and Wisconsin, April–September 2020. MMWR Morb Mortal Wkly Rep 2020;69:1631–4.
[3] King JA, Whitten TA, Bakal JA, McAlister FA. Symptoms associated with a positive result for a swab for SARS-CoV-2 infection among children in Alberta 2021;193:E1–9.
[4] Szablewski CM, Chang KT, Brown MM, et al. SARS-CoV-2 transmission and infection among Attendees of an Overnight camp — Georgia, June 2020. MMWR Morb Mortal Wkly Rep 2020;69:1023–5.
[5] Georgia Department of Health. School aged COVID-19 surveillance data. Available at: https://dph.georgia.gov/school-aged-covid-19-surveillance-data. Accessed December 19, 2020.
[6] Bailey LC, Razzaghi H, Burrows EK, et al. Assessment of 135,794 pediatric patients tested for Severe Acute Respiratory Syndrome coronavirus 2 across the United States. JAMA Pediatr 2021;175:176–84.
[7] Hobbs CV, Martin LM, Kim SS, et al. Factors associated with positive SARS-CoV-2 test results in outpatient health Facilities and emergency Departments among children and adolescents aged <18 Years – Mississippi, September-November 2020. MMWR Morb Mortal Wkly Rep 2020;69:1925–9.
[8] U.S. Centers for Disease Control and Prevention. CDC guidance for Expanded screening testing to reduce Silent Spread of SARS-CoV-2. Available at: https://www.cdc.gov/coronavirus/2019-ncov/open-american/expanded-screening-testing.html. Accessed February 2, 2021.
[9] American Academy of Pediatrics. COVID-19 testing guidance. Available at: https://services.aap.org/en/pages/2019-novel-coronavirus/covid-19-infections/clinical-guidance/covid-19-testing-guidance. Accessed February 2, 2021.
[10] American Academy of Pediatrics. COVID-19 guidance for Safe schools. Available at: https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools. Accessed February 2, 2021.
[11] U.S. Centers for Disease Control and Prevention. COVID-19 in children and Teens. Available at: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/children/symptoms.html. Accessed February 2, 2021.
[12] U.S. Centers for Disease Control and Prevention. CDC guidance for pediatric health care Providers. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/pediatric-hcp.html. Accessed February 2, 2021.
[13] Foster CE, Marquez L, Davis AL, et al. A Surge in pediatric coronavirus disease 2019 cases: The experience of Texas Children's hospital from March to June 2020. J Pediatr Infect Dis Soc 2020. https://doi.org/10.1093/jpids/piaa164. piaa164.
[14] U.S. Census Bureau. American Community Survey. American community Survey 1-year estimates, table S0201: Selected population Profile in the United States. 2019. Available at: https://data.census.gov/cedsci. Accessed January 25, 2021.
[15] Pray IW, Ford L, Cole D, et al. Performance of an antigen-based test for asymptomatic and Symptomatic SARS-CoV-2 testing at two University Campuses — Wisconsin, September-October 2020. MMWR Morb Mortal Wkly Rep 2021;69:1642–7.
[16] Leidman E, Duca LM, Omura JD, et al. COVID-19 trends among persons aged 0-24 Years — United States, March 1–December 12, 2020. MMWR Morb Mortal Wkly Rep 2021;70:88–94.
[17] Waselewski EA, Waselewski ME, Chang T. Needs and Coping behaviors of Youth in the U.S. During COVID-19. J Adolesc Health 2020;67:649–52.
[18] Waselewski E, Waselewski M, Harper C, et al. Perspectives of US Youth during COVID-19. Ann Fam Med 2021:2642. https://doi.org/10.1370/afm.2642.

[19] Oosterhoff B, Palmer CA, Wilson J, Shook N. Adolescents' Motivations to Engage in social Distancing during the COVID-19 pandemic: Associations with mental and social health. J Adolesc Health 2020;67:179–85.

[20] Tanner MR, Miele P, Carter W, et al. Preexposure Prophylaxis for Prevention of HIV Acquisition among adolescents: Clinical considerations, 2020. MMWR Recomm Rep 2020;69:1–12.