

Letters

RESEARCH LETTER

SARS-CoV-2 Positivity on or After 9 Days Among Quarantined Student Contacts of Confirmed Cases

Schools reopened during the fall of 2020 with various approaches to mitigate severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. At that time, the US Centers for Disease Control and Prevention (CDC) recommended a 14-day quarantine without testing for close contacts of anyone diagnosed with coronavirus disease 2019 (COVID-19).

However, data indicated that the incubation period for SARS-CoV-2 infection is 4 to 5 days from exposure in adults and is 6 to 7 days from exposure in children,¹⁻³ suggesting that most infected students should test positive by day 9. Therefore, Alachua County, Florida, implemented SARS-CoV-2 testing on day 9 and return to school on day 10 for student contacts of confirmed COVID-19 cases. We evaluated test positivity rates for SARS-CoV-2 infection among these student contacts.

Methods | The project was reviewed by the University of Florida and the Florida Department of Health institutional review boards and was determined to meet the criteria for a public health surveillance activity exclusion. Signed informed consent was obtained from parents before sample collection. Alachua County has 49 schools serving a population of 26 456 kindergarten through 12th grade students. A hybrid model of virtual and in-person instruction was offered; 49% of students were enrolled for in-person instruction.

The Alachua County Health Department provided reverse transcriptase-polymerase chain reaction (RT-PCR) test-

ing of nasopharyngeal swabs for symptomatic students (suspected cases) and contact tracing for COVID-19-positive confirmed cases; RT-PCR and rapid antigen results from private physicians were included for case confirmation. The methods for genetic testing of isolates have been described.⁴ Student contacts of confirmed COVID-19 cases were quarantined and offered RT-PCR testing at day 3 (to exclude students who might have been infected at the same time as the confirmed case) and at day 9; testing was sometimes delayed to days 10 to 14. Asymptomatic students who tested negative on days 9 to 14 could return to school on the day following their negative test. If no testing was administered, a 14-day quarantine was required.

The percentage of student contacts who tested positive on days 9 to 14 was determined. Students who returned to school after a negative test result were monitored for symptoms through day 14. The percentage of COVID-19-positive contacts among elementary and middle school students vs high school students was compared using the Fisher exact test with statistical significance set at $P < .05$ (2-sided) using R version 3.4.1 and R Studio version 1.1.0153 (R Foundation for Statistical Computing for both). Instructional days missed were compared with days that would have been missed if all student contacts of confirmed COVID-19 cases had been quarantined for 14 days.

Results | Between August 1 and November 30, 2020, when the Alachua County SARS-CoV-2 test positivity rate was 4.9%, 495 suspected student cases were tested and 257 (51.9%) were positive for SARS-CoV-2 infection. For these 257 confirmed cases of SARS-CoV-2 infection, 2189 contacts were quarantined,

Table. SARS-CoV-2 Positivity Rates Among Quarantined Student Contacts of Confirmed COVID-19 Cases

	Quarantined student contacts of confirmed COVID-19 cases, No./total (%)		
	Elementary and middle school	High school	All grades
Positive test result for SARS-CoV-2 by test day			
3	0/80 ^{a,b}	14/54 (25.9) ^{b,c}	14/134 (10.4)
9	6/257 (2.3)	14/222 (6.3)	20/479 (4.2)
10	1/76 (1.3)	15/128 (11.7)	16/204 (7.8)
11	0/105	1/31 (3.2)	1/136 (0.7)
12	1/11 (9)	1/2 (50) ^d	2/13 (15.4)
13	0/1	0/3	0/4
14	0/1	1/2 (50) ^e	1/3 (33.3)
Cumulative: days 9-14	8/451 (1.8) ^b	32/388 (8.2) ^b	40/839 (4.8)

Abbreviations: COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

^a There were 33 student contacts of confirmed COVID-19 cases with negative test results on day 3 who were retested on day 9 (or thereafter). None had positive test results.

^b The comparisons between elementary and middle school vs high school for the positivity rates were significantly different ($P < .001$ using the Fisher exact test).

^c There were 24 student contacts of confirmed COVID-19 cases with negative test results on day 3 who were retested on day 9 (or thereafter). One had a positive test result.

^d There was 1 asymptomatic SARS-CoV-2-positive contact who had not been previously tested on day 3 or day 9.

^e There was 1 contact who received a negative test result on day 9 but became symptomatic on day 14 and had a positive SARS-CoV-2 test result.

134 (6.1%) were tested on day 3, and 839 (38.3%) were tested on days 9 to 14. Of the 134 student contacts tested on day 3, 14 (10.4%) were positive for SARS-CoV-2 infection. Of the 839 student contacts tested on days 9 to 14, 40 (4.8%) were positive for SARS-CoV-2 infection. Of the 388 student contacts in high school who were tested, 32 (8.2%) were positive for SARS-CoV-2 infection on days 9 to 14 compared with 8 (1.8%) of 451 student contacts in elementary and middle school who tested positive ($P < .001$; Table).

Among 799 student contacts of confirmed COVID-19 cases with a negative test result on days 9 to 14, only 1 student became symptomatic after returning to school and had a positive SARS-CoV-2 test result on day 14 after an initial negative test result on day 9. The virus from this student was genetically distinct from the virus isolated from the confirmed COVID-19 case to which the student had been exposed (GenBank confirmed case: [MW307809](#); GenBank 9-day student contact: [MW308137](#)). Loss of instruction decreased by 3649 days with the 9-day testing protocol (8097 days missed) compared with a theoretical 14-day quarantine without testing (11 746 days missed).

Discussion | In this study of a 9-day testing protocol for student contacts of confirmed COVID-19 cases in 1 Florida county, a reduction in loss of instructional time was found that was less than what would have occurred with 14-day quarantine. There was no evidence that an earlier return to school with a negative test result was linked with subsequent symptomatic illness. Had students returned to school before day 14 without testing on day 9 or thereafter, 8.2% of high school contacts would have returned to school with SARS-CoV-2 infection. These findings should be considered when evaluating the December 2020 CDC recommendation for a 10-day quarantine without testing or a 7-day quarantine with testing.⁵

Limitations of this study include (1) contact testing ranging from days 9 to 14; (2) lack of testing for students who quarantined for 14 days; and (3) use of symptomatic illness alone for follow-up of negative test results.

Eric J. Nelson, MD, PhD, MS
 Sarah L. McKune, PhD, MPH
 Kathleen A. Ryan, MD
 John A. Lednický, PhD, MS
 Susanne R. Crowe, MHA
 Paul D. Myers, MS
 J. Glenn Morris Jr, MD, MPH&TM

Author Affiliations: Department of Pediatrics, University of Florida College of Medicine, Gainesville (Nelson, Ryan); Department of Environmental and Global Health, University of Florida, College of Public Health and Health Professions, Gainesville (McKune, Lednický); Florida Department of Health, Jacksonville (Crowe); Florida Department of Health, Gainesville (Myers); Emerging Pathogens Institute, University of Florida, Gainesville (Morris).

Corresponding Author: Eric J. Nelson, MD, PhD, MS, Emerging Pathogens Institute, University of Florida, 2055 Mowry Rd, Gainesville, FL 32611 (eric.nelson@ufl.edu).

Accepted for Publication: February 9, 2021.

Published Online: February 19, 2021. doi:[10.1001/jama.2021.2392](https://doi.org/10.1001/jama.2021.2392)

Author Contributions: Mr Myers had full access to all the data in the study and takes responsibility for the integrity of the data and Dr Morris takes responsibility for the accuracy of the data analysis.

Concept and design: Nelson, McKune, Ryan, Lednický, Morris.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Nelson, McKune, Ryan, Morris.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Nelson, Morris.

Administrative, technical, or material support: McKune, Ryan, Lednický, Myers.

Supervision: McKune, Ryan, Morris.

Conflict of Interest Disclosures: None reported.

Additional Contributions: We acknowledge the data aggregation and analysis efforts of Michael Smith, RN, and Cameron Livingston, RN (both with the Alachua County Health Department); the insight and guidance of the Scientific and Medical Advisory Committee members Michael Lauzardo, MD, and Yana Banks, MD (both University of Florida faculty members); and the commitment of the School Board of Alachua County, the Florida Department of Health, the Alachua County Health Department, and the families of Alachua County to keep schools open and safe from COVID-19. No compensation was received by any of these individuals for their role in this study.

Additional Information: Testing, contact tracing, and follow-up were conducted as part of the Alachua County Health Department surveillance of SARS-CoV-2 infection in the Alachua County Schools. Deidentified data were analyzed and shared with permission from the Alachua County Health Department.

1. Macartney K, Quinn HE, Pillsbury AJ, et al; NSW COVID-19 Schools Study Team. Transmission of SARS-CoV-2 in Australian educational settings: a prospective cohort study. *Lancet Child Adolesc Health*. 2020;4(11):807-816. doi:[10.1016/S2352-4642\(20\)30251-0](https://doi.org/10.1016/S2352-4642(20)30251-0)

2. Cevik M, Tate M, Lloyd O, Maraolo AE, Schafers J, Ho A. SARS-CoV-2, SARS-CoV, and MERS-CoV viral load dynamics, duration of viral shedding, and infectiousness: a systematic review and meta-analysis. *Lancet Microbe*. 2021;2(1):e13-e22. doi:[10.1016/S2666-5247\(20\)30172-5](https://doi.org/10.1016/S2666-5247(20)30172-5)

3. Davies NG, Klepac P, Liu Y, Prem K, Jit M, Eggo RM; CMMID COVID-19 working group. Age-dependent effects in the transmission and control of COVID-19 epidemics. *Nat Med*. 2020;26(8):1205-1211. doi:[10.1038/s41591-020-0962-9](https://doi.org/10.1038/s41591-020-0962-9)

4. Lednický JA, Lauzardo M, Fan ZH, et al. Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients. *Int J Infect Dis*. 2020;100:476-482. doi:[10.1016/j.ijid.2020.09.025](https://doi.org/10.1016/j.ijid.2020.09.025)

5. US Centers for Disease Control and Prevention. Options to reduce quarantine for contacts of persons with SARS-CoV-2 infection using symptom monitoring and diagnostic testing. Accessed February 12, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-options-to-reduce-quarantine.html>