Test-to-Stay After Exposure to SARS-CoV-2 in K–12 Schools

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OBJECTIVES: We evaluated the safety and efficacy of a test-to-stay program for unvaccinated students and staff who experienced an unmasked, in-school exposure to someone with confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Serial testing instead of quarantine was offered to asymptomatic contacts. We measured secondary and tertiary transmission rates within participating schools and in-school days preserved for participants.

METHODS: Participating staff or students from universally masked districts in North Carolina underwent rapid antigen testing at set intervals up to 7 days after known exposure. Collected data included location or setting of exposure, participant symptoms, and school absences up to 14 days after enrollment. Outcomes included tertiary transmission, secondary transmission, and school days saved among test-to-stay participants. A prespecified interim safety analysis occurred after 1 month of enrollment.

RESULTS: We enrolled 367 participants and completed 14-day follow-up on all participants for this analysis. Nearly all (215 of 238, 90%) exposure encounters involved an unmasked index case and an unmasked close contact, with most (353 of 366, 96%) occurring indoors, during lunch (137 of 357, 39%) or athletics (45 of 357, 13%). Secondary attack rate was 1.7% (95% confidence interval: 0.6%–4.7%) based on 883 SARS-CoV-2 serial rapid antigen tests with results from 357 participants; no tertiary cases were identified, and 1628 (92%) school days were saved through test-to-stay program implementation out of 1764 days potentially missed.

CONCLUSION: After unmasked in-school exposure to SARS-CoV-2, even in a mostly unvaccinated population, a test-to-stay strategy is a safe alternative to quarantine.

WHAT’S KNOWN ON THE SUBJECT: Coronavirus disease 2019 negatively and disproportionately impacted the kindergarten through 12th grade learning system across the United States because of disruption to in-person learning. Quarantine after close contact with positive school students or staff represents an ongoing impediment to in-person learning.

WHAT THIS STUDY ADDS: Data presented from a 6-week pilot study highlight the efficacy and safety of a test-to-stay approach in schools with universal masking, with substantial reduction in missed school days, no within-school tertiary transmissions, and secondary transmissions consistent with previous reports.


This trial is registered at www.clinicaltrials.gov (identifier NCT05052580).

Drs Boutzoukas, Kalu, Moorthy, and Mann conceptualized and designed the study, and reviewed and revised the manuscript; Drs Kim, Brookhart, Anstrom and Rak, Ms. Edwards, and Mr. Fist designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript; Drs Weber, Shane, Bryant, Moore, Tilson, and Scott, and Ms. Uthappa reviewed and revised the manuscript; Drs Campbell, Zimmerman, and Benjamin conceptualized and designed the study, drafted the initial manuscript, designed the data collection instruments, collected data, carried out the initial analyses, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.
The coronavirus disease 2019 (COVID-19) pandemic resulted in widespread kindergarten through grade 12 (K–12) school building closures during the 2020–2021 school year. With school closure and remote learning, substantial learning loss has been documented. Children of color and those from less educated households were more likely to lack access to in-person education and demonstrate up to 60% lower math and English proficiency than those who are White or from more educated households,1 thereby further widening the gap of disparities in child education. Additionally, children have experienced increased food insecurity, loss of in-person special education services, and have reported mental health and well-being challenges resulting from the pandemic.2 Fortunately, most K–12 school buildings have reopened their doors, but keeping children in school buildings remains challenging. Mandatory quarantine of unvaccinated, unmasked close contacts for up to 14 days after exposure has been a widely used strategy to limit spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) within K–12 school buildings. Quarantines have resulted in millions of missed school days. In the fourth quarter of the 2020–2021 school year in North Carolina (NC) alone, there were more than 400,000 missed public school days because of quarantine.3

Days of quarantine are lost days of instruction, as well as lost social–mental health support; such losses have long-term impacts. Importantly, recent data suggest that, with mitigation measures, including universal masking in K–12 schools, the risk of SARS-CoV-2 transmission to a close contact is low, thereby limiting the benefit of quarantine for school communities.4 In NC during the spring semester of 2021, <1% of quarantined in-school contacts developed COVID-19 in the universally masked environment, with most close contacts resulting from brief, unmasked encounters, including organized sports, daily meals, and masking nonadherence. Strategies that limit quarantine and promote in-school instruction while limiting risk of SARS-CoV-2 transmission in school buildings are needed.

To address learning losses secondary to quarantines and limit the spread of SARS-CoV-2 in the school and surrounding community, some school districts have begun implementing “test-to-stay” strategies, whereby a close contact avoids quarantine by undergoing serial testing for COVID-19 over a specified duration of time. Test-to-stay implementation varies substantially from region to region, but has undergone minimal systematic evaluation. As a result, test-to-stay widespread use and consideration in national policies has been limited. We evaluated the feasibility, effectiveness, and safety of a test-to-stay strategy in a universal masking environment in NC, with a predominantly unvaccinated school population, where quarantine is required if either the index case or close contact is unmasked but is not required for mask-on-mask student or staff exposures, regardless of the distance between the SARS-CoV-2-infected individual and the exposed contact.

**METHODS**

**Study Design and Population**

The ABC Science Collaborative designed a prospective, cohort study in collaboration with the North Carolina Department of Health and Human Services to evaluate if test-to-stay is an effective, viable, and safe approach to reduce quarantine while minimizing spread of SARS-CoV-2 in the masked K–12 school environment. Schools and school districts were eligible for participation if they had a universal masking policy in place on October 18, 2021, and received board of education and local health department approval. The ABC Science Collaborative proactively introduced the study to eligible districts that were previous collaborators and had an established precedent of collecting and transferring quality data related to the COVID-19 pandemic.

Individuals from participating districts were eligible for inclusion if they had an unmasked exposure and did not meet specific criteria for exemption from quarantine, were asymptomatic, and consented to participate in the test-to-stay research protocol via a Research Electronic Data Capture e-consent. The majority of schools and districts elected to provide the Research Electronic Data Capture e-consent link to potential participants after the known exposure. Close contacts were identified through schools’ contact tracing program5 and were then invited to participate in the study. Individuals were also excluded if they were exposed outside of the school setting, or if they were notified of close contact status >6 days after exposure. Participants who had a second exposure during the testing period were withdrawn from the study at the time of second exposure.

**Testing Program and Data Collection**

After electronic informed consent and assent, participants were assigned a unique identifier. The protocol required that participants undergo SARS-CoV-2 rapid antigen testing (Quidel QuickVue SARS Antigen or BinaxNOW Professional) on the day of notification and every...
other day, up to 4 times during the first 7 days after known exposure (eg, days 1, 3, 5, and 7 after exposure). Testing occurred in the school in all sites except 1 district that established a centralized testing location outside the schools. Tests scheduled for a weekend were to be performed the Friday before or Monday after. In all circumstances, the final test was required, even if occurring several days late. Although participants remained in school if they tested negative, they were not allowed to continue athletic activities because of potential risk of transmission with reduced fidelity of masking in this setting.6

A positive COVID-19 test or the development of symptoms on any day after exposure required isolation according to state public health guidelines.7 Data recorded included basic demographic information, daily presence, or absence of symptoms for 14 days after exposure, whether the infected person (index case) or close contact was masked, exposure setting (eg, indoor or outdoor, and specific location), test results, school absences, and transmission to other close contacts. Data regarding school-level mitigation practices were also collected and recorded using AirTable, a cloud-based database, or standard Excel spreadsheets. Schools and districts transferred anonymized data weekly to the Duke Clinical Research Institute for analysis.

**Definitions and Outcome Measures**

The primary safety outcome for this study was within-school tertiary transmission of SARS-CoV-2, defined as transmission to within-school close contacts of positive test-to-stay participants. The secondary safety outcome was secondary transmission, defined as test positivity among test-to-stay participants occurring after day 1 of exposure. The primary efficacy outcome was days of in-school education saved, defined as the number of days a participant was allowed to attend in-person learning after being notified of exposure to a close, in-school contact who tested positive for SARS-CoV-2.

**Statistical Analysis**

We used descriptive statistics to characterize the study population and circumstances surrounding exposure to the in-school index case, including masking status of case and contact. We also described the day of notification relative to the day of exposure and initial test, and day of test positivity by index case and close contact masking status. We summarized the proportion of test-to-stay participants with a positive test (secondary transmission) and the proportion of positive in-school close contacts of a positive test-to-stay participant (tertiary transmission). We characterized proportions overall, by student or staff, by school district, and by school level (elementary, middle, high). To account for the within-school correlation of outcomes, we estimated the 95% confidence interval (CI) for the proportion using a generalized linear mixed model with districts as a random effect. To support data decision-making, we estimated a posterior distribution for the secondary transmission risk using a Bayesian β-binomial conjugate model with a noninformative β distribution. We adjusted the information in the

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**FIGURE 1**

Diagram of eligible students. Diagram of eligible students in 6 universally masked NC school districts participating in test-to-stay program.
participants of sensitivity symptoms department participants tested transmission to-stay observed unspecified department number symptoms, the quarantine and protocol variable.

Median infected number from primary analyses required for quarantine days to determine the number of missed days. The number of missed school days were summarized by development of symptoms and interquartile range because of missed days and reported positive or developed symptoms. For all other school staff, we used school calendar days to determine the number of missed school days.”

We analyzed school absences by symptoms, test positivity, or other unspecified reasons and compared the absences to those that would have occurred in the absence of the test-to-stay protocol. We analyzed absences that occurred in the absence of the test-to-stay protocol.”

All districts 3020 367 (12.2) 365 (99.5) 175 of 367 (47.7) 285 of 365 (78.1) 56 of 365 (15.3) 55 of 367 (15.0)
District 1 2828 31 (88.6) 31 of 31 (100) 15 of 31 (48.4) 31 of 31 (100) 0 of 31 (0) 1 of 31 (3.2) 28 of 31 (90.3) 3 of 31 (9.7) 0 of 31 (0)
District 2 1642 60 (100) 60 of 60 (100) 25 of 60 (41.7) 46 of 58 (79.3) 6 of 58 (10.3) 15 of 58 (25.0) 41 of 60 (68.3) 15 of 60 (25.0) 4 of 60 (6.7)
District 3 226 1 (100) 1 of 1 (100) 1 of 1 (100) 1 of 1 (100) 0 of 1 (0) 1 of 1 (100) 0 of 1 (0) 1 of 1 (100) 0 of 1 (0) 0 of 1 (0)
District 4 36 112 155 (47.9) 135 of 135 (100) 63 of 135 (46.7) 104 of 135 (77.0) 22 of 135 (16.3) 20 of 135 (14.8) 54 of 135 (40.0) 20 of 135 (14.8) 61 of 135 (45.2)
District 5 963 118 11 (9.3) 9 of 11 (81.8) 5 of 11 (45.5) 9 of 11 (81.8) 1 of 11 (9.1) 0 of 11 (0) 11 of 11 (100) 0 of 11 (0) 0 of 11 (0)
District 6 2940 2524 129 (5.1) 129 of 129 (100) 66 of 129 (51.2) 94 of 129 (72.8) 27 of 129 (20.9) 18 of 129 (14.0) 41 of 129 (31.8) 52 of 129 (40.3) 36 of 129 (27.9)

K–5, kindergarten through fifth grade; —, not applicable.

We estimated the observed data using an estimated posterior probability of the secondary transmission rate as greater than or equal to 5%, the midpoint of the transmission rates (2.5% to 7.5%) on the basis of the observed data from universally masked K–12 schools in the era of the delta variant. 4

TABLE 1 Demographics of Students and Staff Exposed to Index Case

<table>
<thead>
<tr>
<th>Total Students and Staff Eligible to Participate in Test-to-Stay</th>
<th>Students, n of N (%)</th>
<th>Total Students and Staff Enrolled in Test-to-Stay, n</th>
<th>Gender, n of N (%)</th>
<th>Hispanic, Latino, or Spanish Origin, n of N (%)</th>
<th>Elementary School (K–6), n of N (%)</th>
<th>Middle School (6–8), n of N (%)</th>
<th>High School (9–12), n of N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student population from all districts</td>
<td>71261</td>
<td>—</td>
<td>—</td>
<td>29911 of 71261 (42)</td>
<td>35805 of 71261 (53)</td>
<td>15147 of 71261 (18)</td>
<td>15535 of 71261 (22)</td>
</tr>
<tr>
<td>All districts</td>
<td>3020</td>
<td>367 (12.2)</td>
<td>365 of 367 (99.5)</td>
<td>175 of 367 (47.7)</td>
<td>285 of 365 (78.1)</td>
<td>56 of 365 (15.3)</td>
<td>55 of 367 (15.0)</td>
</tr>
<tr>
<td>District 1</td>
<td>2828</td>
<td>31 (88.6)</td>
<td>31 of 31 (100)</td>
<td>15 of 31 (48.4)</td>
<td>31 of 31 (100)</td>
<td>0 of 31 (0)</td>
<td>1 of 31 (3.2)</td>
</tr>
<tr>
<td>District 2</td>
<td>1642</td>
<td>60 (100)</td>
<td>60 of 60 (100)</td>
<td>25 of 60 (41.7)</td>
<td>46 of 58 (79.3)</td>
<td>6 of 58 (10.3)</td>
<td>15 of 60 (25.0)</td>
</tr>
<tr>
<td>District 3</td>
<td>226</td>
<td>1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>0 of 1 (0)</td>
<td>0 of 1 (0)</td>
</tr>
<tr>
<td>District 4</td>
<td>3611</td>
<td>155 (47.9)</td>
<td>135 of 135 (100)</td>
<td>63 of 135 (46.7)</td>
<td>104 of 135 (77.0)</td>
<td>22 of 135 (16.3)</td>
<td>20 of 135 (14.8)</td>
</tr>
<tr>
<td>District 5</td>
<td>963</td>
<td>11 (9.3)</td>
<td>9 of 11 (81.8)</td>
<td>5 of 11 (45.5)</td>
<td>9 of 11 (81.8)</td>
<td>1 of 11 (9.1)</td>
<td>0 of 11 (0)</td>
</tr>
<tr>
<td>District 6</td>
<td>2940</td>
<td>129 (5.1)</td>
<td>129 of 129 (100)</td>
<td>66 of 129 (51.2)</td>
<td>94 of 129 (72.8)</td>
<td>27 of 129 (20.9)</td>
<td>18 of 129 (14.0)</td>
</tr>
</tbody>
</table>

K–5, kindergarten through fifth grade; —, not applicable.
who had a positive test on exposure date or day 1 after exposure. We also conducted a sensitivity analysis including participants who developed symptoms during days 2 to 14 after exposure and never underwent SARS-CoV-2 testing (presumed positive) or had a positive SARS-CoV-2 test after day 7.

We used SAS software, version 9.4, to conduct all statistical analyses (SAS Institute, Inc. Cary, NC). This study was approved by the Duke University Health System institutional review board under Pro00109436 and the North Carolina Department of Health and Human Services. A committee external to day-to-day study procedures oversaw weekly review of the data.

RESULTS

During the study period, from October 18, 2021, to December 8, 2021, we enrolled 367 (12.2%) participants from 5 NC school districts and 1 charter school, out of 3020 eligible students and staff exposed to index cases (Fig 1). A sixth district underwent study startup, but delayed testing because of staffing limitations. Nearly all study participants were students (99.5%) and most were White (78%) (Table 1). Most participants enrolled from the 2 largest school districts (264 of 367, 72%), with 367 of 3020 (12%) eligible participants consenting to participate, and highly variable consent rates across the districts (5%–100%) (Table 1).

Nearly all (215 of 238, 90%) exposure encounters occurred during predefined lunch and athletic activities between an unmasked index case and an unmasked close contact, with most exposures (353 of 367, 96%) occurring indoors, specifically in the context of lunch (137 of 357, 39%) or during athletics (45 of 357, 13%) (Fig 2).

The median (IQR) day of notification was 3 days (2–4) from the day of known exposure (Table 2). Nurses and administrators performed testing at each school building in 5 of 6 participating entities, with 1 district performing testing using centralized locations throughout the district. A sensitivity analysis including those identified as positive on exposure day or day 1 after exposure resulted in a SAR of 2.8% (95% CI, 1.2%–6.2%). The posterior probability of a SAR >5% was 10%. Of 11 participants who developed symptoms, 5 were presumed positives or had a positive test after day 7. A sensitivity analysis including participants who developed symptoms during days 2 to 14 after exposure and never underwent SARS-CoV-2 testing (presumed positive) or had a positive SARS-CoV-2 test after day 7.

Transmission and School Absences

A total of 883 tests were performed, with results in 357 test-to-stay participants. There was a median (IQR) of 3 (2–3) tests per participant. Six participants had a positive test after day 1, leading to a secondary attack rate (SAR) of 1.7% (95% CI, 0.6%–4.7%). The nonparametric estimate of test positivity probability for the interval-censored data, because of the testing strategy, is 2.8% (Table 3). At the time of data lock, the posterior probability of a SAR >5% was 2%. The median (IQR) day of positivity is 4.5 (4–5) days after exposure. Three participants were positive on day 1 after exposure and 1 participant tested positive on the exposure day. All 10 positive cases were found at the first administered test.
### Table 2: Baseline Exposure Characteristics of Students and Staff Exposed to Index Case

<table>
<thead>
<tr>
<th>Total Students and Staff Enrolled</th>
<th>Days to Notification of Exposure, (^a)</th>
<th>Percent Vaccinated, (n) of (N) (%)</th>
<th>Percent Index Case Masked, (n) of (N) (%)</th>
<th>Percent Unmasked of (N) (%)</th>
<th>Percent Masked Participants Exposed to Index Case, (n) of (N) (%)</th>
<th>Percent Unmasked Participants Exposed to Index Case, (n) of (N) (%)</th>
<th>Percent Exposed Indoor, (n) of (N) (%)</th>
<th>Percent Exposed Outdoor, (n) of (N) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All districts</td>
<td>Median (IQR)</td>
<td>3.0 (2.0–4.0)</td>
<td>2 of 367 (0.5)</td>
<td>20 of 241 (8.3)</td>
<td>221 of 241 (91.7)</td>
<td>20 of 258 (8.4)</td>
<td>218 of 258 (8.4)</td>
<td>353 of 366 (96.4)</td>
</tr>
<tr>
<td>District 1</td>
<td>3.0 (1.0–4.0)</td>
<td>0 of 31 (0)</td>
<td>0 of 31 (0)</td>
<td>31 of 31 (100)</td>
<td>1 of 31 (3.2)</td>
<td>30 of 31 (98.3)</td>
<td>28 of 31 (90.3)</td>
<td>3 of 31 (9.7)</td>
</tr>
<tr>
<td>District 2</td>
<td>3.0 (2.0–4.0)</td>
<td>0 of 60 (0)</td>
<td>0 of 60 (0)</td>
<td>60 of 60 (100)</td>
<td>0 of 60 (0)</td>
<td>0 of 60 (0)</td>
<td>0 of 60 (0)</td>
<td>0 of 60 (0)</td>
</tr>
<tr>
<td>District 3</td>
<td>3.0 (1.0–4.0)</td>
<td>0 of 1 (0)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
<td>1 of 1 (100)</td>
</tr>
<tr>
<td>District 4</td>
<td>3.0 (2.0–4.0)</td>
<td>0 of 135 (0)</td>
<td>5 of 135 (3.7)</td>
<td>130 of 135 (96.3)</td>
<td>8 of 135 (5.9)</td>
<td>127 of 135 (94.1)</td>
<td>126 of 135 (93.5)</td>
<td>9 of 135 (6.7)</td>
</tr>
<tr>
<td>District 5</td>
<td>3.0 (0.0–0.0)</td>
<td>2 of 11 (18.2)</td>
<td>11 of 11 (100)</td>
<td>0 of 11 (0)</td>
<td>0 of 11 (0)</td>
<td>0 of 11 (0)</td>
<td>0 of 11 (0)</td>
<td>0 of 11 (0)</td>
</tr>
<tr>
<td>District 6</td>
<td>3.0 (2.0–5.0)</td>
<td>0 of 129 (0)</td>
<td>3 of 129 (100)</td>
<td></td>
<td></td>
<td></td>
<td>128 of 129 (100)</td>
<td>0 of 129 (0)</td>
</tr>
</tbody>
</table>

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\(^a\) If the exposure notification date was not reported, the first test date was used to calculate days to notification of exposure.

### Discussion

In the universally masked environment, implementation of the test-to-stay protocol successfully reduced student absences after in-school exposure to COVID-19. Furthermore, this is 1 of the first systematic, individual-level research studies of test-to-stay strategy for SARS-CoV-2 within the school environment. This is of interest in the context of current efforts toward whole genome sequencing of local strains and delayed transmission in low secondary transmission rate is likely because the number of required tests may be no upgraded ventilation strategies in place which have lower sensitivity including the posterior probability of SAR > 3.1% (95% CI, 1.4%–6.5%) and the transmission. One case of tertiary transmission occurred in a household contact transmitted in-person learning. These data are consistent with reports in the lay press and systematic research studies of test-to-stay strategy for SARS-CoV-2. Our school transmission, school transmission, school transmission, and substantially reduced student absences after in-school exposure to SAR-CoV-2 infection than to acquire infection within school building. Therefore, we identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions. Incidences of within-school tertiary transmission was 1.3%. We identified no tertiary transmissions.
and specificity compared with nucleic acid amplification tests, especially in asymptomatic persons. Nevertheless, the test-to-stay method relies on rapid turnaround of results that is usually not available with nucleic acid amplification tests and serial testing increases the sensitivity of this method. Furthermore, rapid antigen tests have greater sensitivity under circumstances where the pretest probability is higher (eg, after exposure or with symptoms). Third, community rates were declining in NC during the study period (Supplemental Table 4); the point estimate for SARS-CoV-2 may be higher with a more transmissible variant such as omicron, and contact tracing to identify close contacts may become more difficult. Fourth, because of logistics and delays in notification, not every participant received 4 tests; this may have limited the ability to identify all participants who were positive. Such issues demonstrate real-world challenges with implementing a test-to-stay program. Finally, in some districts, the proportion of enrolled participants was far lower than others and enrolled participants did not represent the racial and ethnic distribution of the district. For example, District 6 had the highest number of eligible participants, yet implementation of the protocol within this district was limited by a centralized testing location, which contributed to very limited participation. Each district promoted the study within their schools, and participation varied widely. The low enrollment rate may be explained by execution under a research protocol or centralized testing within this district, which required additional transportation resources for participants. This arrangement may have limited equitable access to those who did not have access to transportation or caregivers with available time.

Based on available data, test-to-stay offers an important opportunity to limit absences and promote in-person learning during the current pandemic and could serve as a blueprint for preventing school closures and absences during the next pandemic. Considering the deleterious effects of chronic absenteeism on risk of dropout, future earnings, and related mortality, such a strategy is crucial to halt learning loss acquired over the 2020 and 2021 school years.

**TABLE 3 School Absence Because of Positive COVID-19 Tests and/or Symptoms in Test-to-Stay Participants**

<table>
<thead>
<tr>
<th>Total Students with Positive COVID-19 Test or Symptoms After Known Within-School Exposure, n</th>
<th>Total Students with Positive COVID-19 Test After Known Within-School Exposure, n of N (%) 95% CI</th>
<th>Total Number of School Days Missed Because of Positive COVID-19 Test After Exposure, n</th>
<th>Median (IQR)</th>
<th>Total Students with Symptons After Known Within-School Exposure, n of N (%) 95% CI</th>
<th>Total Number of School Days Missed Because of Symptoms After Exposure, n</th>
<th>Median (IQR)</th>
<th>Total School Days Missed per Quarantine Policy, n of N (%) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>All districts</td>
<td>20</td>
<td>10 of 355 (2.8) (1.3–6.2)</td>
<td>10, 8 (6–10)</td>
<td>11 of 357 (3.1) (0.4–20.2)</td>
<td>11, 7 (2–8)</td>
<td>136 of 1764 (7.7)</td>
<td>N/A</td>
</tr>
<tr>
<td>District 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>District 2</td>
<td>4</td>
<td>1 of 60 (1.7)</td>
<td>1, 10 (10–10)</td>
<td>4 of 60 (6.7)</td>
<td>4, 7 (2–11)</td>
<td>26 of 291 (8.9)</td>
<td>N/A</td>
</tr>
<tr>
<td>District 3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>District 4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>District 5</td>
<td>2</td>
<td>0 of 9 (0)</td>
<td>2 of 9 (22.2)</td>
<td>2, 7 (6–7)</td>
<td>13 of 72 (18.1)</td>
<td>10</td>
<td>50 (18.1)</td>
</tr>
<tr>
<td>District 6</td>
<td>5</td>
<td>5 of 129 (3.9)</td>
<td>5, 6 (5–6)</td>
<td>0 of 128 (0)</td>
<td>—</td>
<td>30 of 571 (5.3)</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Supervised among participants who completed the 14-d follow-up.

Total school days actually missed by students who had a positive test or symptoms.

Total school days potentially missed by students without a positive test or symptoms and actually missed from students with a positive test or symptoms, per quarantine policy.

Districts 1 and 3 did not report any positive tests among enrolled participants during the study period.

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**CONCLUSIONS**

We found substantial evidence to safely implement a test-to-stay strategy in universally masked school environments, with no evidence of tertiary transmission and thousands of school days saved during our study period. Furthermore, we found that a test-to-stay strategy is a safe alternative to quarantine even after unmasked in-school exposure (eg, during lunch) to SARS-CoV-2 in a mostly unvaccinated population. Although this initiative represents a feasible and safe strategy to allow in-person education, it requires resources and additional support to the school districts. Supporting school districts with policy and financial resources to conduct this protocol on each school’s campus would improve the program’s reach and may help reduce disparities related to testing uptake, direct and indirect burden of testing, time to test, and missed school days. Future investigation should evaluate test-to-stay strategies in optionally masked settings and among those with nonhousehold exposures outside the school setting. In conjunction with already proven measures such as vaccination, rapid identification, and tracing of positive SARS-CoV-2 cases, the test-to-stay
approach should be part of a comprehensive plan for the safe return to in-person education.

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ABBREVIATIONS

CI: confidence interval

COVID-19: coronavirus disease 2019
K-12: kindergarten through 12th grade
NC: North Carolina
SAR: secondary attach rate
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the National Institutes of Health.

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