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## Short Communication

## Implementation of Test-to-Stay programming to minimize learning loss in a pre-K-8 school district

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## ABSTRACT

**Objectives:** Determine if a school-based Test-to-Stay (TTS) program designed to minimize learning loss reduced the incidence of COVID-19 in a US primary school district.**Study design:** Observational, simple summary analysis of attendance and effectiveness of a TTS program implemented in a California school district.**Methods:** Retrospective analysis of nested medical and demographic data. Survival curves were plotted using a cumulative hazard function to compare the probability of infection among close contacts exposed at school at different points of time between participants who participated in TTS versus those who did not participate in TTS. A Cox proportional hazards regression model with time-dependent covariates was used to estimate the association of TTS status with the incidence of SARS-CoV-2 infection.**Results:** Univariate Cox regression analysis revealed that after adjustment, enrollment in TTS was negatively correlated with the risk of SARS-CoV-2 infection (hazard ratio 0.096; 95% confidence interval [CI], 0.024–0.390;  $P < 0.001$ ).**Conclusions:** TTS is an effective component of a layered protection strategy to prevent COVID-19 transmission in schools and communities, while minimizing the loss of in-person instruction in primary schools.

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## Introduction

The COVID-19 pandemic catalyzed an unprecedented global disruption in education. According to the United Nations Education, Scientific and Cultural Organization (UNESCO), students in the USA experienced full or partial school closure for 71 weeks with the greatest number of closures occurring in 2020. The upheaval of traditional in-person education has left school-aged children particularly affected due to interruption in learning, inequitable technology access, social isolation, and limited access to quality nutrition and safe environments.<sup>1,2</sup> This negative sequelae of school closures disproportionately affect minority and low-income families, further widening the disparity of education and health in the USA.<sup>1</sup> Early in the pandemic, schools adopted closure policies as a mitigation strategy to prevent the spread of COVID-19. However, as the virus' prevalence continues to stabilize, education systems are

defining new strategies to educate and promote the health and well-being of children.

Test-to-Stay (TTS) is the use of high-frequency, low-barrier testing in a targeted group of individuals to mitigate the harmful effects of quarantine while minimizing the risk of spread of COVID-19 in classrooms and communities. In the K-12 space which includes students ages 5–18 years, that means testing students who have been exposed to COVID-19. TTS has been used in various forms across the country, with state- or district-specific variations, but all with the purpose of protecting children's health while minimizing loss of in-person education. Schools in Utah used TTS in the 2020–2021 school year, and findings suggest this approach was pivotal to keeping kids in school even during the winter surge.<sup>3</sup> This program saved an estimated 109,752 days of in-person instruction, with only 3.2% of students who participated in TTS testing positive.<sup>3</sup> In December 2021, the Center for Disease Control and Prevention (CDC) issued updated guidance stating that schools may use TTS to minimize the impact of quarantine and limit school absences after a COVID-19 exposure in the K-12 school setting.<sup>4</sup> Innovative interventions such as TTS are pivotal as we enter a new paradigm of COVID-19. By ensuring in-person instruction, these programs are

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foundational to reducing academic socio-economic inequity while ensuring the health and safety of the population.<sup>1,2</sup>

## Methods

### Participants

This retrospective study reviews the incidence rate of COVID-19 in 49,232 students in the Campbell Union School District (CUSD). CUSD is located near San Jose, California and used TTS among students enrolled in pre-kindergarten to 8th grade beginning in September 2021. Diagnosis of COVID-19 was based on the interim guidelines of the CDC and national diagnosis and treatment guidelines for detection of SARS-CoV-2, the virus which causes COVID-19. Individuals were categorized into two groups by their participation in TTS. CUSD students are 46.9% Hispanic/Latino, 23.1% White, and 17.7% Asian/Pacific Islander. A total of 31.6% of students are English Language Learners and 40.9% are enrolled in Free or Reduced Lunch Programs. In total, 6186 students enrolled in TTS in 2021.

Lincoln School District is a pre-K to 12th grade public school district in Lincoln, Nebraska serving 42,258 students. 65.3% of the students are White, 14.3% are Hispanic/Latino, and 6.6% are Black. 9.3% of students are English Language Learners and 33.8% of students are eligible for Free or Reduced Lunch Programs.<sup>5</sup> Lincoln does not have a TTS program in place. Both school districts have mandated universal masking.

The TTS program involved opt-in semi-weekly testing of all students, teachers, and administrators and consisted of an anterior nares sample for SARS-CoV-2 PCR. Individuals with positive samples were considered positive for COVID-19, isolated, and excluded from school for 10 days per the current CDC recommendation at that time. Upon infection, these individuals were excluded from participation in TTS due to CDC guidance discouraging repeated testing in the first 90 days after infection.

Enrollment and inclusion criteria for TTS were as follows: 1) those considered close contacts (individuals who were in less than 6 feet proximity to a known case for a cumulative of 15 min or more over a 24-h period); 2) both parties were masked during the exposure; 3) ongoing masking was maintained; 4) exclusion from all school extracurricular activities for 7 days; 4) remained asymptomatic; and 5) underwent at least twice weekly testing during the quarantine period. Participants were ineligible for participation in TTS if: 1) opt-ed out of school screening; 2) hospitalized; 3) exposed outside of a school setting; and 4) infected with SARS-CoV-2 in the past 90 days.

### Data collection

Data regarding demographics, grade, school, gender, clinical symptoms, and laboratory values were collected by screening specialists. Written consents were obtained from all participants of students participating in TTS.

TTS COVID-19 screening was performed at each school twice a week by Grapefruit Health, an organization of healthcare providers and public health professionals who provide COVID-19 screening, testing, mitigation consultation, and contact tracing services across the USA. As part of the TTS program, Grapefruit used Rapid Antigen Testing with reflex RT-PCR testing with a partner laboratory, with results typically available within 36 h of testing. Tests were obtained by trained laboratory collection personnel. Different modalities and platforms of RT-PCR holding Emergency Use Authorization (EUA) from the FDA were used throughout the course of testing. Patients' symptoms such as fever, cough, sore throat, dyspnea, body chills, headache, myalgia, or gastrointestinal symptoms were recorded and treated as a probable case until

confirmatory PCR resulted. All patients with either a positive rapid antigen and/or a positive (RT-PCR) test via nasopharyngeal swab were considered a confirmed case of COVID-19.

Data were reviewed from September 19, 2021, to November 28, 2021, with the time to event (diagnosis of COVID-19) measured in weeks. The incidence rate of each school was calculated weekly over the course of 11 weeks. The incidence rate was calculated by totaling the number of new COVID-19 cases per district per week and dividing by the sum of the person-time of the at-risk population.

### Statistical analysis

Data were analyzed using SPSS, version 28. Survival curves were plotted using a cumulative hazard function to compare the probability of infection at different points of time and to compare the incidence of COVID-19 among participants who participated in TTS versus those who did not participate in TTS. A Cox proportional hazards regression model with time-dependent covariates was used to estimate the association of TTS status with the incidence of COVID-19.

## Results

A total of 3794 COVID-19 tests were reviewed. There were 90 positive tests among those who participated in the TTS program and 1052 among those who did not. Of the close contacts who participated in TTS, 2648 remained negative for COVID-19, and two tested positive. The incidence of COVID-19 among individuals who participated in TTS was 0.21% compared to 2.49% among individuals who did not participate in TTS.

Survival analysis began on September 19, 2021, until positive test or end of the study period (whichever came first). The univariate Cox regression analysis revealed that after adjustment, enrollment in TTS was negatively correlated with the risk of COVID-19 infection (hazard ratio 0.096; 95% confidence interval [CI], 0.024–0.390;  $P < 0.001$ ). In other words, those who participated in TTS were 90.4% less likely to test positive in a given week compared to those who did not participate in TTS (see Fig. 1).

## Discussion

Persistent absenteeism due to COVID-19 is detrimental to child development, impacting social and emotional well-being, access to nutrition, and learning.<sup>6,7</sup> Consistent masking, social distancing, hand washing, and adequate airflow are important to reducing in-school COVID-19 transmission.<sup>8</sup> In addition, modified quarantine procedures and TTS guidelines are new interventions aimed at improving the safety of in-person instruction. This study's results build on existing evidence demonstrating that TTS practices decrease absenteeism and enable more in-person instruction in K-12 schools.<sup>4</sup> The incidence of COVID-19 infections and thus school exposures was lower for those students who attended schools with TTS than those who did not, saving an estimated 8088 number of days of in-person instruction. This study's findings are congruent with results from TTS programs in New Jersey, Utah, and Massachusetts and suggest that routine school-based COVID-19 screening for students and their close contacts in conjunction with other evidence-based interventions is an efficient and scalable tool to preserve in-person classroom instruction and extracurricular activities and to lessen the inequality gap in public health and education overall.<sup>3,9,10</sup>

### Limitations

Missing demographic information, specifically for non-TTS participants, may have contributed to research bias and

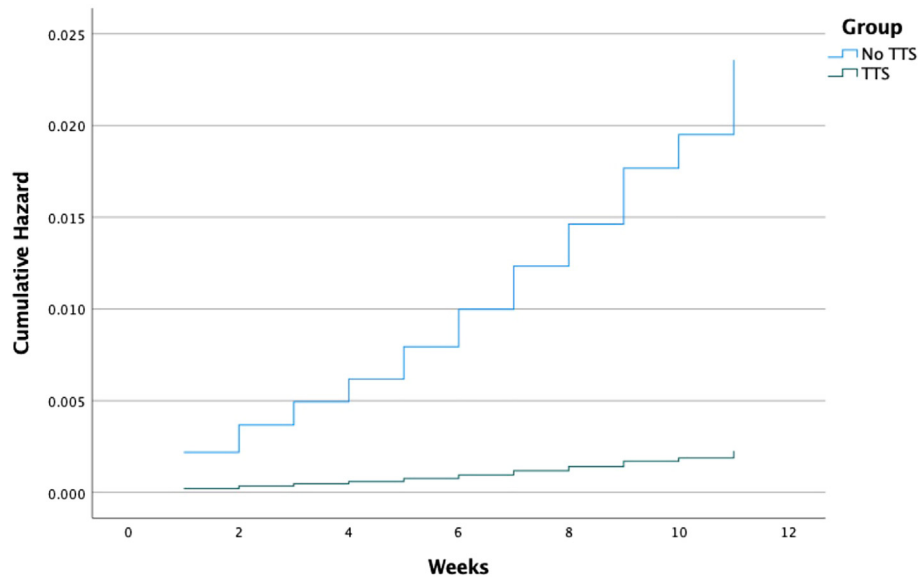


Fig. 1. Proportional hazard of COVID-19 infection for Test-to-Stay participants.

threatened internal validity. In addition, participants may have received COVID-19 testing at other locations and not reported the results to their school district. In the absence of this information, our conclusions regarding the factors associated with incidence and TTS protective qualities may be unreliable. Inevitably, not all confounding variables were controlled for, including socio-economic demographics, which warrants further study. Finally, all subjects in this study lived in Lincoln, Nebraska, and San Jose, CA threatening the external validity and applicability to unlike cohorts. These findings require further validation for generalizability to geographically diverse and prospective cohort studies.

### Conclusion

Test-to-Stay in pre-K-8 schools is an effective component of layered protection strategies which schools and communities can use to minimize the risk of COVID-19 infection, while maximizing in-person education. Minimizing the number of missed school days leads to fewer disruptions in school systems that students rely on such as meals and educational resources. Quickly identifying students, staff, and close contacts who test positive for COVID-19 can mitigate infection spread amongst school systems, thus maximizing in-person education for students.

### Author statements

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### Ethical approval

None sought

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None declared.

### Competing interests

None declared.

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