Phased Return of Students to 77 Transitional Kindergarten-8th Grade Schools With Cohesive Mitigation Strategies Serving as Protective Factors Against the Increase of COVID-19 Cases in Marin County: September 2020-January 2021

Shayne Q. Paff, Rochelle Ereman, Lisa Santora, Bethany Dominik, Alana McGrath, Jasmine Soriano, Karina Arambula, Charis Baz, Matthew Willis, Michaela F. George

1. Epidemiology and Public Health, Marin County Department of Health and Human Services, San Rafael, USA 2. School of Public Health, Baylor University, Waco, USA 3. Whole Person Care, Marin County Department of Health and Human Services, San Rafael, USA 4. Global Public Health, Dominican University, San Rafael, USA

Corresponding author: Shayne Q. Paff, shaynepaff@gmail.com

Abstract

Background and objective

Earlier uncertain implications of the coronavirus disease 2019 (COVID-19) pandemic on the pediatric population prompted the authorities to close schools worldwide under the premise that school settings would serve as drivers of an increase in the cases of COVID-19. Safe and equitable full-in-person school instruction is a critical factor in the continued educational gains of children and for their general well-being. The objective of this study was to report epidemiological trends related to the increasing percentage of students returning to in-person instruction, the suspected in-school transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, and countywide COVID-19 case rates during the first 21 weeks of school reopening in Marin County, CA, in the fall of 2020.

Materials and methods

The institutional review board (IRB) approval was waived for this study as it did not involve any identifiable human subjects data. Retrospective electronic reviews of countywide COVID-19 daily case count and COVID-19-related reports associated with in-person school participants from 77 schools in Marin County, CA, from September 8, 2020, to January 29, 2021, were conducted. The data were made available in collaboration with the Marin County Office of Education (MCOE) and Marin County Department of Health and Human Services (Marin HHS). Descriptive trends analyses were performed to determine whether the phased increase of students attending in-person learning was a significant contributor to countywide COVID-19 incidence rate, crude rate, and in-school COVID-19 viral transmission. This is the first long retrospective study of COVID-19 data among the reopened school population during the second half of the first pandemic year. It was conducted in a 21-week surveillance period involving an immense collaboration between Marin County’s public health officials and school administrators.

Results

Over the 21-week observational period involving 17,639 students, 4,938 school staff, and 899,175 student days, the countywide COVID-19 crude rate decreased (from 89.9 to 35.89 per 10,000) as more students returned to in-person learning. The schools’ strict adherence to public health guidance and site-specific safety plans against COVID-19 yielded a significantly reduced incidence rate of 0.84% among in-person learning participants; only nine cases were traced to suspected in-school SARS-CoV-2 transmission by way of rigorous contact tracing. The countywide COVID-19 incidence rate was 2.09%.

Conclusions

It is possible to minimize COVID-19 transmissions in in-person learning settings with cohesive mitigation strategies, specifically strict adherence to proper masking by students and staff while on school grounds. There is no clear correlation that the increasing phased return of students to in-person school drove an increase in countywide COVID-19 cases in Marin County, CA. Our findings revealed that schools were capable of safely resuming operations by following public health orders and recommendations. The increasing percentage of students returning to in-person school did not drive an increased COVID-19 case rate in the community. On the contrary, this analysis revealed that there was a drop in countywide COVID-19 cases as the phased student return percentage increased.

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prolonged the closure of in-person learning in the United States since March 2020, disproportionately affecting families of lower socioeconomic status [4], single parents, and those with special-needs children [5]; this further exacerbated disparities in education delivery, and has infused anxiety among all stakeholders involved, especially among educators [6], regarding the safety of school reopening.

Since the fall of 2020, several public schools in the United States [7-9] and across the world [9-11] have safely resumed in-person learning, while many private schools and select special education centers have continued to operate on approved in-person instruction waivers. The studies [7-11] pertaining to these schools have reported that with the right mitigation measures on school sites, in-person learning can be safely conducted, leading to only minimal in-school transmission of the disease at worst. They have concluded that in-person learning participants, with compliance to proper masking, physical distancing, and stable cohort strategies did not drive widespread SARS-CoV-2 transmission [7-11]. Additionally, a South Korean study [12] of hospitalized children (median age of seven years) diagnosed with COVID-19 and their caretakers reported no child-to-adult SARS-CoV-2 transmission with proper masking, further adding to the evidence that personal protective equipment (PPE), such as well-fitted two to three ply fabric or surgical masks, is effective at mitigating COVID-19 spread and that child-to-adult SAR-CoV-2 transmission is a rare occurrence [13]. Furthermore, previous studies [14] have reported that adult-to-child transmission occurred more prevalently in settings where there is household mixing of adults in the absence of proper use of face coverings, physical distancing, and adequate ventilation.

This research report describes the protective trends observed over a 21-week period among 77 reopened Transitional Kindergarten–8th Grade (TK-8) Schools and special education schools in Marin County, CA, that adhered to site-specific safety plans and involves 17,659 students [15] and 4,938 school staff [15] who participated in in-person learning for 899,175 student days [16]. We aim to highlight how the school reopening correlated with lower countywide COVID-19 case rates as more students returned to school sites for in-person learning over the 21-week surveillance period. We also emphasize the need for timely and continued dissemination of evidence-based information on safety feasibility [17] for in-person learning on school sites, with the purpose of alleviating the escalating anxiety among educators and families regarding the resumption of full in-person instruction at schools. We engage in a discussion on the SARS-CoV-2 Delta variant with reference to a published case report on an outbreak in a small school where an unvaccinated teacher’s noncompliance with consistent masking protocol resulted in multiple in-school transmissions of the COVID-19 virus.

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**Materials And Methods**

A week-to-week observational trends analysis was performed to investigate whether the phased return of TK-8 students correlated with an increase in countywide COVID-19 cases. Data used in the analysis was made available in collaboration with the Marin County Office of Education (MCOE) and Marin County Department of Health and Human Services Epidemiology COVID-19 Surveillance (Marin HHS COVID-19 Surveillance), Marin County Case Investigation/Contact Tracing (CI/CT), Marin County School Dashboard (MCSD), and Schools Data Team (SDT). The observational study period began on September 8, 2020, as schools in Marin County, CA, started a phased resumption of in-person learning, adopting county and state guidelines [17-18] for safe school reopening. The study period involved a 21-week observational period of countywide and school-related COVID-19 cases. It included a sample population of 17,639 students and 4,938 school staff who participated in in-person learning for a duration of 899,175 student days. The data collected only pertain to the surveillance period starting from September 8, 2020, through January 29, 2021. Data from the mentioned sources were extrapolated from the official Marin County Health and Human Services (Marin HHS) and MCOE websites. The access to view the Excel spreadsheet and Google Sheet for data collection was granted by the designated entities from each organization. Correspondence with MCOE and Marin HHS epidemiologists, public health officers, and public health nurses confirmed the credibility of the collected data.

COVID-19 case was defined based on the California Department of Public Health (CDPH) standards, as a laboratory test result confirmed through polymerase chain reaction (PCR) testing. A school-related case was defined as a COVID-19 case in a student or school staff involved in in-person learning. All school-related cases underwent thorough case investigation and contact tracing. A case investigator and contact tracer from Marin HHS gathered information about the school-related positive case, including close contacts, whereabouts and activities, and compliance with public health orders and recommendations. A suspected in-school transmission was defined as an event where SARS-CoV-2 was most likely transmitted between individuals while on school grounds. Countywide COVID-19 case counts were based on routine county-level reporting of daily laboratory-confirmed (by PCR testing) COVID-19 cases.

Marin County public health officials and school district administrators developed a 30-point plan [15] for safe school reopening, which was instituted as the guideline for school districts to reopen for in-person learning. Marin County public health officials also developed a team dedicated to keeping schools open throughout the first year of the pandemic. Each school was required to designate a public health liaison to be abreast of current and rapidly evolving public health guidance for safe school operations. Weekly webinars between Marin County public health officials and school administrators were instituted to provide support and guidance. Face covering was required for all in-person learning participants. Students in TK to 2nd grade were supported and taught how to properly wear a face mask. Certain outdoor activities on school grounds were scheduled for students to briefly remove face coverings. Meals were individually plated or bagged and served outside as deemed feasible or in classrooms by dividing students into cohorts. Physical distancing of
six feet was observed in the classroom. All essential workers on school grounds were required to adhere to these guidelines. Non-essential school visits during operational hours were restricted.

**Results**

School-related COVID-19 incidence rate was found to be lower (0.84%; 189 cases among 22,571 persons) than the countywide COVID-19 incidence rate (2.09%; 5,450 cases among 260,814 persons) [18]. Marin HHS Schools Tally data sheet [19] reported nine of the 189 school-related cases as suspected in-school transmissions: seven among students, two among school staff. No child-to-adult SARS-CoV-2 transmission was reported to have occurred on school sites per CI/CT, with the term adult referring to school staff. These results are descriptive accounts of all COVID-19 cases in Marin County from September 8, 2020, to January 29, 2021.

A high incidence of COVID-19 community cases was observed between July 2020 and August 2020. In the following 12 weeks after the first 73 schools reopened for in-person learning, the countywide COVID-19 community cases decreased as well. An exponential increase of COVID-19 community cases occurred during the period from November 30, 2020, to January 08, 2021, followed by a steep decline of COVID-19 community cases during the period from January 11, 2021, to January 29, 2021 (Figure 1).

A week-to-week trends analysis shown in Figure 2 compares countywide COVID-19 cases, percentage of in-person learning students, weekly cumulative school-related COVID-19 cases, and suspected in-school transmissions. A steady decline in countywide COVID-19 cases began two weeks after the initial school reopening phase. From November 23, 2020, to November 29, 2020, the percentage of in-person learning students declined from 50.4% in the previous week to 21.14%. Countywide COVID-19 cases began to exponentially increase during that same week, which continued for three weeks despite the steady percentage of in-person learning students returning to schools. A momentary decline of countywide COVID-19 cases was observed from December 21, 2020, to December 27, 2020, the week of the winter holidays. An exponential increase for two weeks (December 28, 2020, through January 10, 2021) ensued soon after in the absence of in-person learning from December 21, 2020, to January 3, 2021. A steady decline of countywide COVID-19 cases was observed as in-person learning participants returned to school sites at a constant rate after the winter holidays.
Figure 3 shows the breakdown of suspected in-school transmission cases. Of the nine suspected in-school transmission cases [19] to have occurred on school grounds, seven were from public schools, and two were from private/independent or parochial schools. Five were reported as between students, two between school staff, two as staff-to-student, and no instances of student-to-staff transmission were reported. Of the nine suspected in-school transmissions, one was among grade TK-2 students, three were among grade 3-5 students, one was among grade 6-8 students, two were among teachers/school staff, and two were among special education students.

**FIGURE 3: Descriptive statistics of nine suspected in-school transmissions**

**Discussion**

Findings from this descriptive analysis suggest that with proper site-specific safety plans, the 77 reopened Marin County schools were capable of safely conducting in-person learning with minimal in-school SARS-CoV-2 transmission during the 21-week observational period. While these are not causal associations, we observed that as the percentage of students returning to in-person learning increased, there was a concurrent decrease in countywide COVID-19 cases in Marin County. The increasing percentage of students returning to in-person learning appeared to serve as a protective factor against an increase in community-based COVID-19 cases, effectively mitigating an increase in countywide COVID-19 cases, as illustrated in Figures 1, 2.

For example, over the Thanksgiving holiday school break, spanning the period from November 23, 2020, to November 29, 2020, and the two-week winter holiday school break, from December 21, 2020, to January 3, 2021, countywide COVID-19 cases increased in the absence of in-person learning participants at the school sites. This observed trend could have been confounded by the increased travels, social gatherings, and mixing of different households. Also, it is important to note that these observational findings were noted...
they include social behaviors when public health orders were relaxed and tightened, and these may have observational trends and descriptive analysis. Several confounding factors add limitations to the study, and a limitation to this study is that no causal correlation was determined. The results of this study entail are implemented.

safely operate during the pandemic, provided that safety protocols as advised by their public health officials community. In addition, similar international studies have reached the same conclusion that schools can school with adherence to proper mitigation strategies did not lead to an increase in COVID-19 cases in the nation have arrived at conclusions that mirror this study’s results, in that the return of students to in-person school administrators, represent the major strengths of the study. Similar studies from other counties in the study at the county level, with collaboration between county epidemiologists, public health officials, and epidemiologists from Marin County’s Public Health Division and the strengths of this study include the collaboration of a credible variety of case investigators, contact tracers, public health officials, and epidemiologists from Marin County’s Public Health Division and administrators from the Office of Education. This 21-week long retrospective review of countywide COVID-19 cases and school COVID-19 data entails a longer study period than previously published studies of its kind. The study captured the trends of COVID-19 school data, including during two major fall/winter holidays. The sample size of the student population that returned to in-person school, and conducting the study at the county level, with collaboration between county epidemiologists, public health officials, and school administrators, represent the major strengths of the study. Similar studies from other counties in the nation have arrived at conclusions that mirror this study’s results, in that the return of students to in-person school with adherence to proper mitigation strategies did not lead to an increase in COVID-19 cases in the community. In addition, similar international studies have reached the same conclusion that schools can safely operate during the pandemic, provided that safety protocols as advised by their public health officials are implemented.

A limitation to this study is that no causal correlation was determined. The results of this study entail observational trends and descriptive analysis. Several confounding factors add limitations to the study, and they include social behaviors when public health orders were relaxed and tightened, and these may have contributed to the results. The socioeconomic contrast between the rich and poor areas of Marin County may also have contributed to the direction of the case rate. The disparity caused by this social determinant of health leads to overcrowding and multi-family dwelling scenarios, which then becomes a petri dish conducive for the rapid spread of respiratory viruses, including SARS-CoV-2.
Conclusions
Acquisition and transmission of COVID-19 among participants of in-person learning appears to be minimal among the 77 Marin County schools included in our 21-week surveillance period. There was a two-fold decrease in countywide COVID-19 cases as the percentage of students returning to in-person learning increased. The increases in COVID-19 community cases do not appear to be correlated with the increase in the percentage of in-person learning students. Suspected in-school SARS-CoV-2 transmission was minimal among these school settings. This surveillance study demonstrated that it is possible to mitigate COVID-19 outbreaks in in-person learning settings within school communities, besides helping to reduce the COVID-19 incidence rate in the community, even before COVID-19 vaccines were made accessible to educators and the pediatric population in the age bracket of 5-11 years above. These findings can be applicable to the SARS-CoV-2 Delta variant and the winter season ahead.

It is incumbent on public health officials and school administrators to collaboratively develop an effective and consistent policy to stabilize school reopening prior to achieving fully-vaccinated status for the pediatric population. Public health prioritization of safe school reopening will improve the loss of education equity nationwide and worldwide for all students, and alleviate anxiety among stakeholders involved in the school reopening during a still rapidly-evolving pandemic. The scenario where pediatric COVID-19 vaccines will be accessible to the population in the age bracket of 5–11 years brings added hope in terms of the reopening of in-person instruction at schools globally.

Additional Information
Disclosures
Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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