Preventing COVID-19 Transmission in Education Settings

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Abbreviations: coronavirus disease 2019 (COVID-19), Centers for Disease Control (CDC), San Francisco Department of Public Health (SFDPH), Department of Children, Youth, and Their Families (DCYF)

Article Summary: We conducted a mixed-methods study of educational settings to assess COVID-19 mitigation policies. We observed variable adherence to policies and minimal COVID-19 transmission.

What’s Known on This Subject: The Centers for Disease Control outlined policies to mitigate COVID-19 spread in K-12 schools (to facilitate safe reopening). School promotion of these policies has been associated with limited school-based transmission, and lower in-school transmission compared to community rates.

What This Study Adds: We directly observed adherence to COVID-19 mitigation policies in educational settings. We found variable adherence to policies and minimal COVID-19 transmission (despite high community incidence). We detail barriers and potential strategies for implementing COVID-19 mitigation policies.
Contributor’s Statement

Dr. Kaiser conceptualized and designed the study, analyzed and interpreted the data, drafted the initial manuscript, and reviewed and revised the manuscript.

Ms. Watson, Ms. Camano Sosa, Ms. Olarte, Ms. Dorsey, Ms. Su, and Dr. Bardach conceptualized and designed the study, analyzed and interpreted the data, and reviewed and revised the manuscript.

Ms. Dogan, Mr. Karmur, Ms. Warren, Ms. Wang, Dr. Brown, and Dr. Sachdev analyzed and interpreted the data and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.
Abstract

Objectives:

In Fall 2020, community hubs opened in San Francisco, California, to support vulnerable groups of students in remote learning. Our objectives were to: 1) describe adherence to COVID-19 mitigation policies in these urban, low-income, educational settings, 2) assess associations between policy adherence and in-hub COVID-19 transmission, and 3) identify barriers and facilitators of adherence.

Methods:

We conducted a mixed-methods study from November 2020-February 2021. We obtained COVID-19 case data from the Department of Public Health, conducted field observations to observe adherence to COVID-19 mitigation policies, and surveyed hub leaders about barriers and facilitators of adherence. We summarized quantitative data using descriptive statistics and qualitative data using thematic content analysis.

Results:

A total of 1,738 children were enrolled in 85 hubs (39% Hispanic/Latino, 29% Black). We observed 54 hubs (n=1175 observations of children, 295 observations of adults). There was high community-based COVID-19 incidence (2.9-41.2 cases/100,000 residents per day), with 36 cases in hubs, and only one case of hub-based transmission (adult-to-adult). Sixty-seven percent of children and 99% of adults were masked. Fifty-five percent of children and 48% of adults were distanced ≥6 feet. Facilitators of mitigation policies included: for masking—reminders, adequate supplies, and “unmasking zones;” for distancing—reminders and distanced seating.
Conclusions:

We directly observed COVID-19 mitigation in educational settings, and we found variable adherence. However, with promotion of multiple policies, there was minimal COVID-19 transmission (despite high community incidence). We detail potential strategies for increasing adherence to COVID-19 mitigation.

Introduction

COVID-19 pandemic-related school closures have had negative impacts on the over 56 million school-age children in the US, with studies demonstrating declines in cognitive and social development, reductions in access to food, and increases in depression and anxiety. These impacts are largest for the most vulnerable children, including children with learning and/or physical disabilities, children from low-income families, and children of color.

Due to the severe impacts of school closures on children, the American Academy of Pediatrics and other national organizations strongly recommend reopening schools safely. The Centers for Disease Control (CDC) have provided guidance on COVID-19 mitigation policies for supporting safe school reopening, including: 1) universal and correct use of masks among students and staff; 2) maintaining physical distance of ≥6 feet (recently changed to ≥3 feet); 3) keeping children and staff in stable cohorts and minimizing mixing; 4) limiting classroom/cohort sizes; 5) encouraging frequent handwashing; 6) maximizing ventilation/air circulation; 7) excluding students or staff with symptoms of illness; and 8) regularly cleaning high-touch surfaces.
Prior studies from North Carolina and Wisconsin have demonstrated low rates of COVID-19 transmission in the context of efforts to follow these policies. However, these studies did not explicitly focus on urban, low-income settings, where COVID-19 mitigation may be more challenging. Additionally, no studies to our knowledge have directly observed and described adherence to these policies in indoor educational environments. Thus, there are critical gaps in our understanding of the feasibility of policy implementation, the effectiveness of these policies in preventing COVID-19 transmission, and the barriers and facilitators of implementation.

In Fall 2020, sites across San Francisco, California, opened as community hubs—spaces “where students who may struggle with remote instruction can go to access their digital classwork and the social interactions that distance learning cannot provide.” Hubs prioritized English-language learners, low-income families, children in public housing or the foster care system, youth experiencing homelessness, and racial/ethnic minority populations. Hubs aimed to follow all COVID-19 mitigation policies outlined by the CDC. We studied these urban, low-income, educational settings to achieve the following objectives: 1) describe adherence to COVID-19 mitigation policies; 2) assess associations between policy adherence and COVID-19 transmission; and 3) identify barriers and facilitators of adherence. This knowledge can help guide school and community leaders, teachers, and staff in safer school reopening.

**Methods**

**Study Design and Setting**

This mixed-methods study involved community hubs in San Francisco, California, and took place from November 2020-February 2021. Hubs were designed to support remote learning,
as San Francisco public schools were closed to in-person learning during this time. Hubs provided electronic tablets, internet access, free meals and snacks, and some enrichment and physical education programming. Hubs aimed to follow the COVID-19 mitigation policies outlined by the CDC (Table 1). Hubs were located in a variety of community facilities (e.g., libraries, community centers, recreation centers) that were closed to the public. Sites were selected based on availability (no structural/space criteria). They were open five days per week, with the majority open 8am-5pm. Families were required at enrollment to commit to children attending 4 full days per week, and adult staff committed to part or full-time hours. Hubs had two adult staff available to supervise each group (up to 12 children). Adult staff were paid “Youth Development Professionals,” whose focus was to help support the social emotional development of children by fostering healthy relationships, providing a safe and supportive environment, encouraging positive peer interaction through community building, and creating space for youth voice. The San Francisco Department of Public Health made COVID-19 vaccination available to hub staff after the close of our study (February 23, 2021). Children of multiple age/grade levels were enrolled in each hub. Children were recruited for enrollment via the Department of Children, Youth, and Their Families (DCYF); school- and community-based organizations; city agencies (e.g., Human Service Agency, Department of Homelessness and Supportive Housing); and the San Francisco Unified School District. Hubs prioritized enrollment of the vulnerable groups described above (e.g., children in public housing or the foster care system, youth experiencing homelessness) and also allowed enrollment of other children that were previously receiving services at the community facility.
Study Population

The study population consisted of children ages 5-18 years and staff in the hubs (median 6 child observations, 1 adult observation per classroom/space observed). DCYF collected demographic data on children at the time of enrollment (e.g., grade level, race). These data were self-reported by parents/guardians. We acknowledge that race is a social construct, not a genetic or biological category. We summarize racial demographic data to better describe the study population, but we do not perform any modeling/analyses with race as a predictor. Both the San Francisco Department of Public Health (SFDPH) and the University of California, San Francisco institutional review board approved this study as public health surveillance.

Data Collection and Analyses

Data was collected via four sources: COVID-19 surveillance by the SFDPH, in-person survey of hub administrative leaders, field observations of hubs, and electronic survey of hub administrative leaders. Quantitative data were analyzed using SAS version 9.4 (Cary, NC), and qualitative data were analyzed using Dedoose version 8.3.45 (Manhattan Beach, CA).

COVID-19 Surveillance Data

Summary data on COVID-19 incidence in San Francisco during the study period, total COVID-19 cases among children and adults/staff in the hubs, and total cases of hub-based COVID-19 transmission were provided by SFDPH. Children and staff attending the hubs were instructed to get COVID-19 testing if symptomatic or in close contact with a person suspected or confirmed to have COVID-19. Any positive results were reported to SFDPH. SFDPH contacted parents/caregivers of any children who tested positive for
COVID-19, and parents/caregivers were responsible for alerting hub leaders if children tested positive.

**In-person Survey of Learning Hub Administrative Leaders**

Surveying was done during field visits to hubs. These visits occurred in two rounds, from November 3, 2020 to February 4, 2021. During these visits, our research team conducted in-person surveys of hub administrative leaders to ask a series of multiple-choice questions about planned COVID-19 mitigation policies and implementation (e.g., “Have children and adult staff been instructed to stay home if experiencing any symptoms of COVID-19?”), as well as current supplies of personal protective and cleaning equipment (e.g., “Today, are there adequate supplies of cleaning equipment available at the Hub?”). Surveys were designed to inquire about all COVID-19 mitigation strategies outlined by the CDC, and they were pilot tested prior to use [Appendix 1]. Survey data were summarized using descriptive statistics, and data from visit 1 and visit 2 were compared using Chi-square tests.

**Field Visits of Learning Hubs**

Field visits occurred in two rounds. Our research team members conducted observations in all spaces in which children and adults were present at the time of the visit (median 6 child observations, 1 adult observation per classroom/space observed). Observations were done using an adapted version of the previously validated SOPLAY tool (System for Observing Play and Leisure in Youth), a tool based on momentary time sampling. The original SOPLAY tool was designed to collect data on physical activity (categorized as sedentary, walking, or vigorous). This tool was adapted to instead focus
on masking (categorized as not masked, partially masked, fully masked, or unknown) and physical distancing (categorized as distanced <6 feet, ≥6 feet, or unknown). Research assistants were trained in use of the observation tool via a 4-hour training session that included didactics and practice using videos of school settings. Observations involved brief, systematic scans (visual sweeps of a specified area, moving from left to right). Scans were used to quantify the number of children/adults in compliance with masking/distancing at that moment in time. Observations also included characterization of the children (grade level) and environment (e.g., ventilation/number of windows and doors open, hand hygiene supplies). During the first round of visits, research assistants visited a subset of sites in pairs collecting simultaneous, independent observations. These data were used to calculate inter-rater reliability (Cohen’s Kappa: degree of agreement over and above chance). The reliability analyses were done by assessing agreement across pairs of assessors on: 1) characteristics of areas (e.g., ventilation); 2) child/adult masking, and 3) child/adult distancing. We excluded observations in children had removed masks for mealtimes/eating. Observation data were summarized using descriptive statistics. We compared policy adherence between younger and older children and between visit 1 and visit 2 (using Chi-square tests). We could not assess associations between policy adherence and COVID-19 transmission due to low transmission/cases.

Electronic Survey of Learning Hub Leaders

Hub administrative leaders were invited to participate in an electronic survey that contained a series of free-text questions designed to elicit more robust and nuanced information about barriers and facilitators of COVID-19 mitigation policy implementation (e.g., “Please describe what you think has been the most helpful thing
you do at the hub to support students and staff to stay masked"). The addition of these qualitative data to our mixed-methods analysis was intended to shed light on potential drivers behind our quantitative findings on COVID-19 mitigation policy adherence.

Surveys were pilot tested prior to distribution and distributed electronically [Appendix 2]. Survey data were imported into qualitative analysis software and analyzed using inductive thematic content analysis. For the analysis, 5 investigators performed initial open coding. Investigators met while open coding to develop and finalize a codebook that facilitated coding consistency. These investigators then independently coded all data. During this process, investigators met regularly to compare coding consistency, resolve discrepancies, and discuss preliminary findings. When coding was complete, all investigators met to develop themes that encompassed related common codes.

Results:

Community Hubs

The San Francisco DCYF oversaw the opening of 85 learning hubs. These hubs had a total enrollment capacity of 2,010 students. At the start of our study in November 2020, they had enrolled 1,605 students and had 528 adult staff available. By the close of our study in February 2021, they had enrolled 1,738 students and had 562 adult staff available. Students were 54% male, 46% female. Students were 39% Hispanic/Latino, 29% Black, 12% Asian, 8% Multiracial, 3% White, and 9% Other. Most children were in elementary school (grades K-5, n=1312, 75%). Children with special needs were in attendance at 16 (29%) of the hubs. Our results reflect the whole study period.
For this study, we surveyed leaders from 57 hubs and conducted field observations in 54 hubs. We conducted a total of 187 observations of classrooms/spaces in the hubs. There was a median of 6 child observations (IQR 4-9) and 1 adult observations (IQR 1-2) per classroom/space observed. We conducted a total of 1,175 observations of children and 295 observations of adults (661 children and 171 adults during the first round of visits, and 514 children and 124 adults during the second round of visits).

COVID-19 Transmission

During the study period, there were a total of 23 children and 13 adults attending the hubs that were reported to SFDPH as having a COVID-19 positive test result. The SFDPH School Outbreak Response team investigated each of these cases and evaluated whether it was caused by hub-based transmission. Only 1 case was suspected to be an in-hub transmission and was a case of adult-to-adult transmission. All other cases were determined to be community-based. Accordingly, there were no COVID-19 outbreaks in the hubs during the study period (defined as ≥3 epidemiologically-linked cases among students and staff over a 14-day period who are from different households, not identified as close contacts of each other in any other case investigation, and not with a clear source of infection from outside the school setting). Incidence of COVID-19 in the city of San Francisco during this period ranged from 2.9-41.2 cases per 100,000 residents per day.

COVID-19 Mitigation Policies in San Francisco Learning Hubs

Data from our in-person survey of learning hub leaders is presented in Table 1. All 57 hubs participated in the survey (100%). Hubs mandated use of masks for children and adult staff and provided masks (2-ply cloth masks, isolation masks, KN95 masks). All hubs reported
adequate supplies of hand sanitizer/soap, cleaning products, and extra masks for children and staff. Most of the hub sites/facilities did not have central air filtration system in place. There were no significant differences in survey responses from visit 1 to visit 2.

Reliability of Field Observation Tool

Reliability data were collected during 21 visits, with 741 simultaneous measures in 61 areas/classrooms. Cohen’s Kappa was 96% for visual reminders, 100% for hand hygiene supplies, and 78% for number of windows/doors open. Kappa for physical distancing in children was 72% for “distanced” and 72% for “not distanced,” and in adults was 80% for “distanced” and 80% for “not distanced.” Kappa for masking in children was 76% for “masked” and 81% for “not masked,” and in adults was 94% for “masked” and 100% for “not masked.” Of note, Cohen’s Kappa cannot be calculated when agreement is 100%, thus those values reported as 100% represent actual agreement rate. Overall, these levels of agreement range from substantial to almost perfect.

Adherence to COVID-19 Mitigation Strategies

Aggregate field observation data on COVID-19 mitigation are presented in Table 2. Almost all sites kept at least 1 window or door open (92%). Most (94%) had hand hygiene supplies available in the room. Across all sites, a mean of 67% of children and 99% of adults were masked, and a mean of 55% of children and 48% of adults were distanced ≥6 feet. The most common reasons for being in closer proximity were staff interacting with/helping students, students interacting with one another, and lacking adequate space to distance desks ≥6 feet. There were no significant differences comparing visit 1 to visit 2.
Adherence to COVID-19 Mitigation in Younger (K-5th Grade) versus Older (6th-12th Grade) Children

We observed K-5th graders in 50 of the hubs and 6th-12th graders in 34 of the hubs. There were no significant differences in the proportions of younger versus older children masked or physically distanced ≥6 feet (masking 65% in younger and 71% in older children [p=0.66], distancing 57% in younger and 51% in older children [p=0.62]).

Barriers and Facilitators of COVID-19 Mitigation in Indoor Educational Settings

Leaders from 39 (68%) of the hubs responded to the electronic survey. Common themes with exemplary quotes are detailed in Table 3 and described here.

Symptom Screening

Standardized screening tools (e.g., symptom lists) facilitated symptom screening. A common barrier to screening was children having chronic conditions that involved respiratory symptoms (such as allergic rhinitis causing runny nose and sneezing, which are also COVID-19 symptoms and, so, potential grounds for exclusion). They navigated this barrier by asking for support from medical professionals, by requesting a clinician note documenting the symptoms were caused by a chronic condition, or negative COVID-19 testing. Leaders also described how they were concerned about parents and caretakers not reporting child symptoms, possibly because reporting positive symptoms would require keeping the child home and providing or finding childcare. Leaders reported that sometimes it was helpful discussing symptoms with the children directly, as well as directly discussing and better allying with parents around the common goal of
safety. Leaders expressed the need for extra support in educating families about COVID-19 prevention and in accessing COVID-19 testing when needed.

**Masking**

Hub leaders reported that unmasking sometimes persisted after eating or drinking and also occurred during situations in which children were more physically active (thus became uncomfortable wearing masks). Frequent reminders helped facilitate masking, including both verbal and visual reminders (e.g., posters). Staff also provided education on the consequences of not wearing masks and hub policies around masking. These efforts prompted a feeling of collective responsibility, with children sometimes reminding each other to mask. Another facilitator was designating indoor and outdoor “unmasking zones,” spaces where children could be at a safe distance from others when wanting to take his/her mask off for a short time. When children’s masks became soiled, it was also helpful to have extra supplies on hand.

**Physical Distancing**

Leaders described that challenges to physical distancing included free and outdoor play activities, as well as children’s natural tendencies to want to be physically close to others. Staff facilitated physical distancing with kinesthetic activities and verbal and visual reminders. Helicopter arms (e.g., children holding out arms at full length) and providing hula hoops to hold to mark out appropriate distancing provided kinesthetic learning. Visual reminders included items such as six-foot markers on the ground. Hubs also facilitated physical distancing by organizing classrooms with distanced seating and by devising creative games (e.g., games of tag using long pool noodles).
Cohorting

Hub leaders planned to keep children and staff in small groups or cohorts that had minimal to no interactions with other cohorts, so as to minimize overall potential exposure to COVID-19. The most common challenges with cohorting included having siblings or friends that were assigned to different cohorts, and children or staff needing to access shared spaces. Leaders also reported that staff shortages presented a challenge; because when a staff member could not work, another staff member had to supervise a new cohort. Facilitators of cohorting included creating dedicated spaces and supplies so cohorts did not need to share, clear communication and reminders, and staggered scheduling (which minimized exposure to other cohorts during use of common spaces).

Discussion:

Several prior studies have reported low COVID-19 transmission in educational settings that promoted CDC-recommended COVID-19 mitigation policies. However, none to our knowledge have directly observed COVID-19 mitigation adherence or solely focused on urban, low-income settings with high COVID-19 incidence. Thus, there were critical gaps in our understanding of the feasibility, effectiveness, and barriers and facilitators of COVID-19 mitigation implementation. We found adherence to each mitigation policy varied, and we found almost zero hub-based COVID-19 transmission (no child-to-child or child-to-adult transmission). We detail barriers and potential strategies for increasing the adherence to COVID-19 mitigation. Our study provides details on how, with successful layering/promoting multiple COVID-19
mitigation policies, we can achieve safe in-person learning for children in even the most challenging settings.

Our data on COVID-19 transmission in the hubs aligns with other studies of educational settings, showing minimal transmission that was much lower than community-based transmission. There was only one reported case of adult-to-adult transmission during the study period. This was in the context of high community transmission, ranging from 2.9-41.2 cases per 100,000 residents per day in San Francisco. Zimmerman et. al. reported similarly low rates of school- versus community-based transmission in a 9-week study of over 90,000 students in North Carolina schools. They found only 32 cases of school-based COVID-19 transmission, during a period when community-based transmission would have predicted 800-900 cases. Data from Wisconsin and Atlanta, Georgia, schools have similarly shown much lower school-based COVID-19 transmission compared to community-based transmission, and no reported child-to-adult transmission. Our findings also align with a prior simulation study that demonstrated the effectiveness of layering/promoting multiple COVID-19 mitigation strategies in school settings.

Our findings indicate we can achieve safe in-person learning even with imperfect compliance to mitigation policies, reinforcing the model that multiple layers of mitigation decrease transmission in educational settings. We found almost zero hub-based COVID-19 transmission despite only 67% of children wearing masks. This may be have been driven by lower risks of COVID-19 transmission from children versus from adults and/or lower than 100% masking compliance still providing adequate protection against transmission (in the context of other mitigation). We also found only about half of children and adults were distanced ≥6 feet.
This supports more recent data and guidelines that suggest physically distancing $\geq 3$ feet, in the context of masking, may be adequate to prevent COVID-19 transmission.\textsuperscript{16-19} Additionally, most of the hub sites/facilities did not have central air filtration systems in place or the resources to newly install such systems. Of note, most hubs did establish an in-person daily symptom and temperature screening process, but these labor-intensive processes are no longer recommended by the CDC due to a lack of evidence of efficacy for decreasing transmission. CDC now recommends educating caregivers and staff about symptoms and excluding those that have symptoms of illness before arrival.\textsuperscript{20}

Our findings highlight key strategies for increasing masking in children in educational settings. Supporting behavior change is complex, requiring internal motivation, the capability/capacity to change, and environmental supports and cues to support change. Our findings indicate the importance of creating a culture of collective responsibility, in which both adults/staff and children are motivated about keeping everyone’s masks on to ensure everyone’s safety. These settings must also have the capacity to support masking (supplies of extra masks) and create environmental supports (visual reminders, designated unmasking zones). Since children often forget to re-mask after eating, creating staggered schedules of smaller lunch cohorts may also be helpful.

Our study was limited to community-based organizations in San Francisco; thus, our findings may have limited generalizability to other settings with different populations or infrastructure (e.g., buildings/environment, financial resources, staffing capacity/ratios). However, it included over 50 unique buildings/environments in lower-income, diverse, densely-populated urban areas with high COVID-19 incidence; thus, represents a particularly challenging
setting for mitigating COVID-19 transmission. Additionally, our field observation data may be biased by the presence of research staff (e.g., children or adults changing behavior when observed). We limited our qualitative data collection to hub leaders, but parents/caregivers and students may have provided rich data on barriers and facilitators of mitigation; thus, study of these groups represents an important area for future work.

In conclusion, we found adherence to COVID-19 mitigation policies varied. In the context of promoting and layering multiple policies, there was minimal hub-based COVID-19 transmission. We detailed several barriers and potential strategies for increasing adherence to COVID-19 mitigation. This knowledge can help guide educational and community leaders, teachers, and staff in safer school reopening and ongoing operations.

Acknowledgments

We would like to thank and acknowledge all the hub leaders and staff for supporting this study. We would also like to acknowledge Dr. Dan Cooper, Dr. Ricky Camplain, and Dr. Nanette Lopez for support in adapting the SOPLAY tool.
References:


### Table 1. COVID-19 Mitigation Policies in Hubs (from surveys of Hub Leaders)

<table>
<thead>
<tr>
<th>Intended Mitigation Policy</th>
<th>Total (n= 57 sites)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intended Policies for Arrival and Symptom Screening</strong></td>
<td></td>
</tr>
<tr>
<td>COVID-19 testing required for children prior to starting hub attendance (n, %)</td>
<td>4 (7.0)</td>
</tr>
<tr>
<td>COVID-19 testing required for staff prior to starting hub attendance (n, %)</td>
<td>30 (52.6)</td>
</tr>
<tr>
<td>Planned staggered arrival times for children (n, %)</td>
<td>42 (73.6)</td>
</tr>
<tr>
<td>Symptom screening process^ (n, %)</td>
<td></td>
</tr>
<tr>
<td>Symptom screening daily, prior to arrival</td>
<td>4 (7.0)</td>
</tr>
<tr>
<td>Symptom screening daily, upon arrival</td>
<td>47 (82.5)</td>
</tr>
<tr>
<td>Temperature check daily, upon arrival</td>
<td>54 (94.7)</td>
</tr>
<tr>
<td>No daily symptom screening policy in place</td>
<td>1 (2.0)</td>
</tr>
<tr>
<td>Children/staff instructed to stay home if having any COVID-19 symptoms (n, %)</td>
<td>57 (100)</td>
</tr>
<tr>
<td>Children/staff instructed to stay home if around any COVID-19 positive contacts (n, %)</td>
<td>55 (96.5)</td>
</tr>
<tr>
<td><strong>Intended Policies for Hand Hygiene and Cleaning Surfaces</strong></td>
<td></td>
</tr>
<tr>
<td>Mandatory hand hygiene daily upon arrival (n, %)</td>
<td>56 (98.3)</td>
</tr>
<tr>
<td>Minimum times per day children reminded to wash hands (mean, range)</td>
<td>8 (2-25)</td>
</tr>
<tr>
<td>Adequate supplies of hand soap/sanitizer available (n, %)</td>
<td>57 (100)</td>
</tr>
<tr>
<td>Minimum times per day high-touch surfaces cleaned (mean, range)</td>
<td>6 (1-15)</td>
</tr>
<tr>
<td>Adequate supplies of cleaning products available (n, %)</td>
<td>57 (100)</td>
</tr>
<tr>
<td><strong>Intended Policies for Masking</strong></td>
<td></td>
</tr>
<tr>
<td>Mask wearing mandatory for children and adults (n, %)</td>
<td>55 (96.5)</td>
</tr>
<tr>
<td>Mask wearing required for children during physical education and/or recess (n, %)</td>
<td>54 (94.7)</td>
</tr>
<tr>
<td>Adequate supplies of masks available (n, %)</td>
<td>57 (100)</td>
</tr>
<tr>
<td><strong>Intended Policies for Cohorting and Distancing</strong></td>
<td></td>
</tr>
<tr>
<td>Maximum size of cohorts/classrooms (mean, range)</td>
<td>13 (6-18)</td>
</tr>
<tr>
<td>Children planned to share supplies across cohorts (n, %)</td>
<td>4 (7.0)</td>
</tr>
<tr>
<td>Times cohorts allowed to mix (n, %)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>49 (85.9)</td>
</tr>
<tr>
<td>Lunch/meals</td>
<td>3 (5.3)</td>
</tr>
<tr>
<td>Recess</td>
<td>4 (7.0)</td>
</tr>
<tr>
<td>Physical education activities</td>
<td>1 (1.7)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (8.8)</td>
</tr>
<tr>
<td>Normal class time</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Mandatory distancing ≥6 feet during lunch/meal times (n, %)</td>
<td>56 (98.3)</td>
</tr>
<tr>
<td>Mandatory distancing ≥6 feet during physical education/recess (n, %)</td>
<td>56 (98.3)</td>
</tr>
<tr>
<td>Central ventilation/filtration system in place (n, %)</td>
<td>28 (49.1)</td>
</tr>
</tbody>
</table>

*There were no significant differences in survey responses from visit 1 to visit 2; ^Symptoms screened for included fever, chills or repeated shaking/shivering, cough, sore throat, shortness of breath/difficulty breathing, feeling unusually weak or fatigued, loss of taste or smell, muscle pain, headache, runny or congested nose, diarrhea*
Table 2. Field Observations of COVID-19 Mitigation Policies during Regular Class for All Students

<table>
<thead>
<tr>
<th>Mitigation Policy</th>
<th>Overall Compliance (n= 54 sites)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context/Environment</strong></td>
<td></td>
</tr>
<tr>
<td>Visual reminders present (n, %)</td>
<td>34 (63.0)</td>
</tr>
<tr>
<td>Hand hygiene supplies present (n, %)</td>
<td>51 (94.4)</td>
</tr>
<tr>
<td>Ventilation via windows/doors (n, %)</td>
<td></td>
</tr>
<tr>
<td>No windows/doors open</td>
<td>5 (9.3)</td>
</tr>
<tr>
<td>1 window/door open</td>
<td>25 (46.3)</td>
</tr>
<tr>
<td>2 or more windows/doors open</td>
<td>22 (40.7)</td>
</tr>
<tr>
<td>Outdoor setting/not applicable</td>
<td>2 (3.7)</td>
</tr>
<tr>
<td>Fan/air purifier present (n, %)</td>
<td>15 (26.3)</td>
</tr>
<tr>
<td><strong>Masking</strong></td>
<td></td>
</tr>
<tr>
<td>Children fully masked (n, %)</td>
<td>774/1151 (67.2)</td>
</tr>
<tr>
<td>Children partially masked (n, %)*</td>
<td>164/1151 (14.2)</td>
</tr>
<tr>
<td>Adults fully masked (n, %)</td>
<td>293/295 (99.3)</td>
</tr>
<tr>
<td>Adults partially masked (n, %)*</td>
<td>2/295 (0.1)</td>
</tr>
<tr>
<td><strong>Physical Distancing</strong></td>
<td></td>
</tr>
<tr>
<td>Children physically distanced at least 6 feet (n, %)</td>
<td>650/1175 (55.3)</td>
</tr>
<tr>
<td>Adults physically distanced at least 6 feet (n, %)</td>
<td>142/295 (48.1)</td>
</tr>
<tr>
<td>Reasons for not distancing (n, %)</td>
<td></td>
</tr>
<tr>
<td>Staff interacting with students</td>
<td>23 (42.6)</td>
</tr>
<tr>
<td>Students interacting with each other</td>
<td>8 (14.8)</td>
</tr>
<tr>
<td>Desks not spaced due to small room</td>
<td>7 (13.0)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (11.1)</td>
</tr>
</tbody>
</table>

There were no significant differences comparing visit 1 to visit 2; *Partially masked refers to mask only covering nose or mouth, rather than both
### Table 3. Barriers and Facilitators of COVID-19 Mitigation in Indoor Learning Settings (from surveys of Hub Leaders)

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Exemplary Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrier to Screening: Honesty of Respondents</td>
<td>“Parents and children not being honest when answering questions about traveling or having symptoms of illness.”</td>
</tr>
<tr>
<td>Barrier to Screening: Allergies</td>
<td>“Kids with allergies will almost always display a symptom. It's hard to determine how much is pre-existing versus brand new sometimes...”</td>
</tr>
<tr>
<td>Barrier to Masking: Mealtimes and Physical Activity</td>
<td>“People forget to replace their masks on faces after eating or drinking.”</td>
</tr>
<tr>
<td></td>
<td>“I believe they find it difficult to engage in sports or any active activities where they may find it hard to breathe.”</td>
</tr>
<tr>
<td>Barrier to Masking: Wearing Mask Incorrectly</td>
<td>“Some kids have a hard time keeping the mask over their nose; others tend to forget after eating or drinking water.”</td>
</tr>
<tr>
<td>Barrier to Distancing: Free Play</td>
<td>“Recess, and recreational activities is the most difficult aspect of physical distancing. It is nearly impossible to keep students distant for the whole recess when they are running past each other, playing sports, etc.”</td>
</tr>
<tr>
<td>Barrier to Distancing: Children’s Desire to be Close to One Another</td>
<td>“It's the kids’ nature to play together.”</td>
</tr>
<tr>
<td></td>
<td>“Usually, it is when they are having way too much fun and get too excited, we, unfortunately, have to stop and remind them.”</td>
</tr>
<tr>
<td>Barrier to Cohorting: Friends or Siblings in Separate Cohorts</td>
<td>“It's hard when friends or siblings are in different cohorts. They want to say hi and especially for siblings, we have some older youth that have younger siblings and they want to check on them and make sure they're okay or just give them a hug.”</td>
</tr>
<tr>
<td>Barrier to Cohorting: Common Spaces</td>
<td>“The only common space used by more than one cohort is a courtyard. The courtyard is also the space between two cohort rooms and the &quot;front door&quot;. This means if a youth goes home early and the other cohort is in the courtyard, there is a chance for mixing.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facilitators</th>
<th>Exemplary Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitator of Screening: Adequate Equipment</td>
<td>“Thanks to the generosity of the Department for Children, Youth, and Their Families, we have been given adult masks, empty spray bottles, thermometers, and other personal protective equipment.”</td>
</tr>
<tr>
<td>Facilitator of Screening: Adequate Staff Training</td>
<td>“We held multiple training [sessions for] staff prior to hub opening on safety protocols. The center is equipped with thermometers and other personal protective equipment that staff are mandated to practice using every day on themselves, each other, and the students.”</td>
</tr>
<tr>
<td>Facilitator of Masking: Reminders</td>
<td>“We remind the students to keep their masks on (specially over their noses). We model to them by keeping ours on at all times. We talked about the importance of keeping on masks during this challenging time.”</td>
</tr>
<tr>
<td>Facilitator of Masking: Adequate Mask Supplies</td>
<td>“We have masks available when students arrive and at each pod. [Sometimes], students need to change their masks after lunch and having extra available is helpful”</td>
</tr>
<tr>
<td>Facilitator of Masking: Designated Unmasking Zones</td>
<td>“We created a space during outdoor play to have a mask “break” – this helped students spread out when they did need to be unmasked. Also, creating a designated area for eating/taking a break, so there is somewhere for kids to go if they need a snack outside of designated meal times. Basically, if we gave them somewhere to go, they would follow the rules.”</td>
</tr>
<tr>
<td>Facilitator of Distancing: Visual Reminders</td>
<td>“Physically taping off areas, signage, creating squares with tape of areas students are allowed in, taping off 6 ft. distances of furniture and areas for standing.”</td>
</tr>
<tr>
<td>Facilitator of Distancing: Seating Arrangement in Classroom</td>
<td>“Students being seated separately and distancing youth to not face each at their table. Only two youth are allowed per table.”</td>
</tr>
<tr>
<td>Facilitator of Cohorting: Staggered Scheduling for Arrival and Scheduled Use of Shared Common Spaces.</td>
<td>“[We] created schedules for gym time for each class, so [there were] no two classes [that] were in the gym at the same time. Bathrooms were open and monitored by teachers to make sure only 1 student was in at any given time.”</td>
</tr>
<tr>
<td>Facilitator of Cohorting: Designated Space and Supplies for Each Cohort</td>
<td>“Each cohort has a designated indoor and outdoor space. Each cohort has their own bathroom. Each pod has a 5-gallon water cooler in their pod. We included a fridge, microwave, and hot water kettle in each pod for staff to ensure each pod could be self-contained. Basically, we tried to make sure [there] was little to no reason to need to leave the designated pod space.”</td>
</tr>
</tbody>
</table>
Learning Hub Admin Questions

Please complete the survey below.

Thank you!

Researcher Initials

☐ AK
☐ BD
☐ KW
☐ PW
☐ AW
☐ AO
☐ MCS
☐ SK
☐ NB

Date (MM-DD-YY)

Time (HH:MM)

Learning Hub Name

Check ‘Yes’ if this is the second site visit.

☐ Yes

Arrival & Symptoms

Were children required to get COVID-19 testing prior to starting attendance at the Hub?

☐ Yes
☐ No

Were adult staff required to get COVID-19 testing prior to starting attendance at the Hub?

☐ Yes
☐ No

Do children arrive at staggered start times?

☐ Yes
☐ No

Which of the following best describes the symptom screening process at this hub?

☐ Parents and adult staff fill out symptom screener daily before arrival
☐ Parents and adult staff fill out symptom screener daily upon arrival
☐ Parents and adult staff are aware of symptom list and stay home if symptoms are present
☐ Other
☐ No symptom screener
☐ Temperature check at entry
### Have children and adult staff been instructed to stay home if experiencing any symptoms of COVID-19?
- Yes
- No

### Have children and adult staff been instructed to stay home if they find out a close contact has been diagnosed with COVID-19?
- Yes
- No

### Are there children with special needs that have extra staff support at this site?
- Yes
- No

### Arrival & Symptoms Field Notes

### Hygiene & PPE

#### Is there mandatory hand hygiene upon entering the Hub?
- Yes
- No

#### What is the minimum # of times per day children are reminded to wash their hands? (Put 1 number only)

#### Today, are there adequate supplies of hand soap/hand sanitizer at the Hub?
- Yes
- No

#### How many times per day are high-touch surfaces cleaned? (Put 1 number only)

#### Today, are there adequate supplies of cleaning equipment available at the Hub?
- Yes
- No

### Do children share any school supplies across cohorts?
- Yes
- No

### Hygiene & PPE Field Notes

### Masking

#### Is mask wearing mandatory at the Hub?
- Yes
- No
Today, are there extra supplies of masks available at the Hub?  
- Yes  
- No

**Cohorting & Physical Distancing**

What is the maximum planned size for a cohort of children? (Put 1 number only)

At what times does cohort mixing occur?  
- Normal class time  
- Lunch/Meals  
- Recess  
- PE  
- Other  
- None

Are there plans to maintain physical distancing during recess/PE?  
- Yes  
- No

Do children keep masks on during recess/PE?  
- Yes  
- No

Do children stay in the same classroom for lunch/meals?  
- Yes  
- No

Are children physically distanced during lunch/mealtimes?  
- Yes  
- No

What time(s) do students have recess, eat lunch, and/or play outside?

**Cohorting & Physical Distancing Field Notes**

**Ventilation**
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Only use for visit 1!!] What is the HVAC or filtration system in place? **</td>
<td>☐ Draws air from outside</td>
</tr>
<tr>
<td></td>
<td>☐ System minimizes re-circulation</td>
</tr>
<tr>
<td></td>
<td>☐ Other</td>
</tr>
<tr>
<td></td>
<td>☐ Unsure</td>
</tr>
<tr>
<td></td>
<td>☐ No HVAC/filtration system at this site</td>
</tr>
</tbody>
</table>

**VISIT 2 ONLY:**
Do you have a system that filters air throughout the building?

| Yes | No |

Ventilation Field Notes

Field Notes

Misc. Field Notes

Submit
Our team from UCSF is working with the SF Department of Public Health to help support the Community Hubs in safely supporting remote learning. We would like you to complete this short, online survey which asks about your overall experience with symptom screening, masking, cohorting, and physical distancing at your site. Your response will help us better understand the successes and challenges encountered in providing a safe learning space for children during these difficult times.

The survey will take approximately 20 minutes to complete, and you will receive a $15 Amazon e-gift card upon completion of the survey. All surveys will be kept secure and any personal information such as your name and the site name will not be reported. The survey is voluntary, and you do not have to complete it. If you agree to participate, please proceed to fill out the survey below.

### Symptom Screening

1) **What has helped the hub successfully screen staff and students for COVID19 symptoms each day?**

2) **Please describe an example of a problem you have faced in symptom screening.**

3) **Please describe what was done to try to address problems in symptom screening.**

### Masking

4) **Please describe what you think has been the most helpful thing you do at the hub to support students and staff to stay masked.**

5) **Please describe an example of a problem you have faced with mask wearing.**

6) **Please describe what was done to try to address problems related to mask wearing.**
7) Please describe what the hub does that is helpful to prevent cohorts from mixing.

8) Please describe an example of a problem you have faced keeping cohorts.

9) Please describe what was done to address this problem with keeping cohorts separate.

Physical Distancing

10) Please describe what has been helpful to encourage physical distancing

11) Please describe an example of a problem you have faced with physical distancing.

12) Please describe what was done to try to address problems with physical distancing.

Other Comments

13) Please share any other comments you have about successes or barriers to keeping students and staff safe in the hub.
### Preventing COVID-19 Transmission in Education Settings
Sunitha V. Kaiser, Annalisa Watson, Basak Dogan, Akash Karmur, Kristen Warren, Phoebe Wang, Melisa Camano Sosa, Apryl Olarte, Sherrice Dorsey, Maria Su, Lillian Brown, Darpun Sachdev and Naomi S. Bardach

*Pediatrics* originally published online June 10, 2021;

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<th>including high resolution figures, can be found at:</th>
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