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Parents' and caregivers' support for in-school COVID-19 mitigation strategies: A socioecological perspective

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Abstract

Informed by the social ecological model, which asserts that health behaviors and beliefs are the result of multiple levels of influence, we examined factors related to parents' support for in-school COVID-19 mitigation strategies. Using data from a survey of 567 parents/caregivers of public elementary and middle school students in 8 Maryland counties, we employed regression models to examine relationships between parent-, child-, family-, school-, and community-level factors and acceptability of mitigation strategies.

Acceptance of COVID-19 mitigation strategies was positively correlated with child- and family-level factors, including child racial identity (parents of Black children were more accepting than those of White children, OR: 2.5, 95% CI: 1.5, 4.1), parent receipt of the COVID-19 vaccine (OR: 2.4, 95% CI: 1.5, 3.7), and parent Democrat or Independent political affiliation (compared to Republican affiliation, OR: 4.2, 95% CI: 2.6, 6.7; OR: 2.2, 95%CI: 1.3, 3.8, respectively). Acceptance was also positively associated with parents' perceptions of their school's mitigation approach, including higher school mitigation score, indicating more intensive mitigation policies (OR: 1.1, 95% CI: 1.0, 1.1), better school communication about COVID-19 (OR: 1.7, 95% CI: 1.4, 1.9) and better school capacity to address COVID-19 (OR: 1.9, 95% CI: 1.5, 2.4). Community-level factors were not associated with acceptance.

Child- and parent-level factors identified suggest potential groups for messaging regarding mitigation strategies. School-level factors may play an important role in parents' acceptance of in-school mitigation strategies. Schools' capacity to address public health threats may offer an underappreciated and modifiable setting for disseminating and reinforcing public health guidance.

Conflicts of interest

The authors do not have any conflicts of interest to disclose.

Keywords

School health; social ecological framework; behavior change; pandemic response; child health; public health communication theory

Background

The COVID-19 pandemic provided an unprecedented opportunity to explore factors that influence personal beliefs regarding public health approaches and related behaviors. Over the course of 2020, 2021, and 2022, the pandemic posed a significant challenge for public health professionals at local, state, and national levels. At first, it was necessary to determine which viral mitigation strategies were effective in reducing the spread and lessening the impact of COVID-19. Especially in the early months of the pandemic, an evolving understanding of the mode of transmission of the virus made for conflicting and confusing recommendations. Once more was understood about effective mitigation strategies, the challenge became encouraging individuals to adopt behaviors and attitudes that facilitated the use of these mitigation measures in their daily lives.

The reaction to the implementation and encouragement of mitigation strategies was mixed. Some patently rejected the ideas of masking, social distancing, and vaccination as an infringement on their autonomy. Others embraced recommended strategies, pivoting as recommendations changed over time. Some research suggests that acceptance of or adherence to COVID-19 mitigation strategies, such as masking, varied based on individual characteristics such as racial identity or political affiliation (Badr et al., 2021; Kahane, 2021; Sallis et al., 2008). Schools, in particular, presented a unique challenge for public health officials and policymakers for at least two reasons. First, many schools experienced a (sometimes lengthy) period of remote learning before transitioning back to in-person instruction. Second, many schools re-opened prior to the availability of a vaccine for all children, which meant mitigation strategies were critical for student and staff safety. In the absence of stringent national guidelines, a wide variety of school mitigation strategies were adopted at the state and school district levels (Decker, 2021; DeJonge et al., 2022; Pampati et al., 2022; Teasdale & Fleary, 2022).

When working with children to adopt new behaviors, parent/caregiver buy-in is often a key factor in supporting behavior change (Yu-Lefler et al., 2022). Previous research has demonstrated that parent/caregiver engagement can play an important role both in shaping a child's success in school and in creating a healthy school environment (Centers for Disease Control and Prevention (CDC), 2012). A lack of parental support can also derail a school district's plans if there is widespread disagreement. For example, parents in New Jersey took a stand against perceived overuse of standardized testing by refusing to allow their children to sit for a test (Abraham et al., 2019). Regarding the adoption of COVID-19 mitigation strategies in schools, parent/caregiver support is likely important both for student adherence to in-school mitigation policies and for schools and districts' willingness to implement them. For example, a study in Wisconsin found that only one-fifth of students and staff consented to participate in a school surveillance testing plan put in place to identify asymptomatic

cases and prevent disease spread, which may have influenced the effectiveness of this strategy (Falk et al., 2022).

Some studies have suggested that early in the pandemic, parents had mixed feelings about school mitigation strategies; for example, some studies showed that they supported strategies such as daily temperature monitoring of students and frequent hand washing, but not masking, especially in younger children (Amin-Chowdhury et al., 2022; Chua et al., 2021; Meghani et al., 2022). Factors found to be associated with parents' support for and confidence in mitigation strategies have included race, political affiliation, and personal experience with distance learning (Meghani et al., 2022).

This study focused on the state of Maryland during the 2021–2022 school year. As of September 1, 2021, when schools opened, 4.5% of weekly hospital admissions in Maryland were due to COVID-19 and there was 8.3% COVID-19 test positivity (Centers for Disease Control and Prevention, 2021; New York Times, 2023). Compared to adults, children experienced less severe symptoms from COVID-19 infection, although serious complications, including Multisystem Inflammatory Syndrome (MIS-C), were a threat (Rathore et al., 2020). During this time, in-school masking was mandated by the state of Maryland, and both masks and COVID-19 tests were widely available to the public (Johns Hopkins Univerity (JHU), 2021). Vaccines were widely available during this time, but only for individuals 12 years and older (U.S. Department of Health and Human Services, 2023).

Social Ecological Perspective

The social ecological perspective conceptualizes health behaviors and beliefs as the result of multiple levels of influence, from individual to broader community and socio-political forces (Israel et al., 2008; Sallis et al., 2008; World Health Organization, 1947). The model has previously been used, for example, to understand determinants of vaccination (Kumar et al., 2012; Latkin et al., 2021), including parents' intentions to vaccinate their children against COVID-19 (Dayton et al., 2022). A social ecological perspective on factors that may shape parents' attitudes about in-school COVID-19 mitigation strategies is shown in Figure 1, along with sample indicators. (Note that we use the term "parents" for brevity, but this group may include other primary caregivers and guardians).

The model in Figure 1 proposes that a parent is influenced by their own background and personal experience with COVID-19. The next level of influence for a parent's beliefs is their child's or children's unique experiences with pandemic-related quarantines, mental and physical health challenges, and educational risks. How a parent perceives their child's risk of negative outcomes from COVID-19 infection and the value of mitigation may have to do with a child's specific health or social risk factors or a parent's attitude about medicine and/or schooling, overall. In turn, these attitudes and perceptions are closely linked to a parent's views on school mitigation strategies for COVID-19. Each family and/or household presents another level of lived experience that could influence a parent's perceived vulnerability to, or assessment of, the costs associated with COVID-19 infection (e.g., food insecurity, a multigenerational household, family members with high-risk health conditions). This experience could also impact a parent's view on school mitigation, as it represents the relative importance of preventing the child from bringing an infection

home from school (and potentially spreading the infection to family members). A child's school comprises the next level of experience, as each school may address COVID-19 and communicate about COVID-19 differently or have different capacity for enacting mitigation strategies. A parent's acceptance of mitigation strategies is likely influenced by both their understanding of viral mitigation strategies and trust in the school's ability to implement them. Finally, a community provides different levels of opportunity for children in general as well as exposing them to varying levels of COVID-19 viral transmission and resources to protect themselves or recover from illness. Community factors impact a parent's acceptance of school mitigation strategies by providing context for developing opinions about the severity of the pandemic, overall, as well as the broader capacity for schools to care for their children.

The purpose of the current study is to understand the factors that influence parents' acceptance of school-based COVID-19 mitigation strategies and to determine whether intervention-relevant insights can be gained by viewing acceptance through a social ecological lens. The understanding of which specific social ecological factors are most closely related to parent acceptance could inform future efforts to improve acceptance of public health strategies overall.

Methods

Data were drawn from the Parents and Communities as Experts (PACE) Study, part of the NIH-RADx Underserved Populations RADx UP Return to School (https://radx-up.org/) initiative. The goal of the PACE Study was to learn how families and communities in Maryland navigated the return to in-person school during the 2021–22 school year, including the acceptability of public health strategies deployed in schools to curb the pandemic. The PACE Study focused on eight counties across Maryland (and their eight corresponding school districts), chosen because they included the highest proportion of families in poverty, individuals from historically excluded racial/ethnic groups, or rural residents. (Additional details are available at https://schoolhealth.jhu.edu/covid19_resources/pace-study/).

We fielded a web- and mail-based survey of parents and caregivers with public school students in grades K-8 to assess their perceptions of and attitudes toward school-based COVID-19 mitigation strategies and barriers and facilitators to returning to and remaining in in-person school. The survey was mailed to a stratified random sample of homes in the eight target counties using a consumer mailing list that oversamples for likelihood of a school-aged child in the home. The sample was enriched for households from historically excluded racial/ethnic groups, rural zip codes, and households with low incomes. In addition, an electronic version of the survey publicized via social media, school districts and community organizations, and community events, was implemented using the Research Electronic Data Capture (REDCap) platform (Harris et al., 2009).

Study eligibility was established using a screening questionnaire that confirmed respondents' eligibility based on being a parent or caregiver of a student in a public school in grades K-8 in an eligible school district. Parents with more than one child were asked to answer the question in relation to their child in grades K through 8 whose birthday was

next at the time of the survey. Only one respondent was allowed per household. Parents were asked about both parent and child demographics, socio-economic status, and experience with COVID-19 infections (both personal diagnosis or diagnosis of those close to them), quarantine, school closures, and the child's mental health.

Parents also reported on acceptability of, confidence in, and efficacy of a range of possible school COVID-19 mitigation strategies. Data were collected from January to June 2022. Participants received a $25 gift card for completing the survey. The Johns Hopkins School of Medicine Institutional Review Board approved the study protocol and respondents provided informed consent.

Acceptability of School-Based Mitigation Strategies

To identify strategies to include in the survey, in Fall 2021, we developed a list of 17 potential strategies garnered from school districts' published school re-opening plans and the Centers for Disease Control and Prevention website (Centers for Disease Control and Prevention, 2022a). We developed a brief face validity survey which was shared with school health partners (researchers and practitioners in school districts or government) and the study's community advisory board (CAB) members. Partners and CAB members (n=27 including 16 CAB members, 7 researchers, and 4 state educational experts) shared feedback on strategy inclusion, exclusion, and wording. Table 1 lists these strategies incorporating five respondent additions and feedback (which yielded a total of 22 mitigation strategies).

In the PACE Study parent survey, we asked, "*Please indicate how acceptable or unacceptable each strategy is for you/your family (that is, if you feel that the strategy should or should not be implemented, regardless of whether or not it is being done in your school)*." Response options (4-point Likert scale) ranged from very unacceptable (0) to very acceptable (3). The Cronbach's Alpha for internal consistency of the 22 items was 0.908. To categorize parents as "acceptors" versus non-acceptors, we calculated the mean of the items (excluding responses of don't know). Most parents (64.2%, n=364) had mean scores that indicated they found most strategies "somewhat" or "very" acceptable" and 35.8% (n=203) had mean scores that indicated they found most strategies "somewhat" or "very" unacceptable. For a summary of frequencies, please see Appendix 1.

Social Ecological Correlates of Accepting School-Based Mitigation

The exposures of interest were the components illustrated in the modified social ecological model outlined in Figure 1 and corresponding measures are detailed in Table 2. The NIH-RADx UP initiative used a set of common data elements (CDEs) to assess demographic characteristics, social determinants of health, and some COVID-19-related risk factors and attitudes. These were common across RADx-UP studies (detailed descriptions of CDEs are publicly available at https://radx-up.org/research/cdes/) (NIH, 2021).

Parent-level measures used to predict acceptability of COVID-19 mitigation strategies included demographics (relationship to child, age, sex, preferred language, education, political party, employment status, health insurance, income, number of people supported by income) trust in school, attitude toward vaccination and general support for mitigation (NIH, 2021). Child-level measures collected included demographics (race, ethnicity, sex, preferred

language, grade in school), global mental health assessment (categorized as excellent/very good/good versus fair/poor), presence of a chronic health condition (yes/no), educational risk (special educational needs, low grades, and/or chronic absenteeism), and overall impact of quarantine in terms of missing in-person school due to the pandemic (Ahmad et al., 2014; NIH, 2021). Family-level measures included food insecurity, whether the household was multigenerational, and/or included a member with a high-risk health condition (Hager et al., 2010; NIH, 2021). School-level measures included the school's COVID-19 mitigation score (a quantification of the school mitigation strategies by district) and assessment of the school's ability to communicate about and address mitigation strategies.

Three community-level predictors of acceptability of COVID-19 mitigation strategies were used, including: 1) the Child Opportunity Index (COI), a nationally-normed, neighborhood-level measure of the quality of resources and conditions for children's development (diversitydatakids.org, 2020; Noelke et al., 2020), 2) Urbanicity of the respondent's residential zip code, categorized using the most recent 2010 Rural-Urban Commuting Area (RUCA) Codes. (USDA, 2020; WWAMI, 2005), and 3) Community prevalence of COVID-19. COVID-19 prevalence for each of the 8 counties included in the study was calculated by dividing cumulative COVID-19 cases in a county (from March 2020 through January 2022) by the county population (Maryland Counties: Population, 2022; Maryland.gov, 2021). For a more detailed description of all survey questions and other measures used in this analysis, see Appendix 2.

Statistical Analysis—Relationships between exposures of interest and parent respondent "acceptor" status were explored first using a series of Chi-squared tests for categorical variables and Student's t-tests for continuous variables. To gain a more detailed understanding of the relationship between the exposures of interest and the odds of being an "acceptor", we employed a series of mixed multi-level univariate logistic regression models, using county/school district as a nesting level to account for clustering of observations within districts. The relationships between the exposures of interest and the outcome of "acceptor" were considered significant if they reached a level of $P < .002$ after a Bonferroni correction for multiple comparisons (p=.05/32 comparisons). All analyses were performed using Stata 17.0 (StataCorp, 2021).

Results

Study Sample Characteristics

The sample for the survey was 567 parents/caregivers of public elementary or middle school children. Seventy-four percent of the sample participated online and 26% participated via mailed surveys. Characteristics of the sample are shown in Table 3 The mean age of respondents was 38.8 years (SD: 6.2), 73.9% (n=418) identified as female, and 74.9% (n=424) identified as having more than a high school education. Most parents identified their children as White (59.4%, n=337) or Black (25.0%, n=142) and 15.0% (n=85) identified their child as Hispanic or Latino. Most (61.7%, n=349) of the respondents reported on a child in elementary school, and 38.3% (n=217) reported on a child in middle school. When asked about political affiliation, 33.7% (n=191) identified as a Democrat, 27.4% (n=155)

identified as a Republican, and 17.1% (n=97) identified as Independent. The majority of parents were employed (75.3%, n=426), had private insurance (57.8%). 34.8% of parents reported an income between $50,000 and $99,999 (n=197) and 16.1% reported an income less than $25,000 (n=91). 64.6% (n=365) of parents reported trusting their child's school as source for correct information about COVID-19, 77.1% (n=435) of parents reported receiving a COVID-19 vaccine and 87.0% reported general support for mitigation measures (n=488).

At the family level, 8.9% of parents reported living in a multigenerational household (n=50) and 34.9% reported having a family member with a high-risk condition in the household (n=198). At the community level, the mean COI was 24.5 (SD 5.0), 85.7% of parents resided in an area considered urban (n=486), 14.3% resided in an area considered rural (n=81) and the mean cumulative community prevalence of COVID-19 was .17% (SD .02) (Table 3).

Child and Family Factors Associated with Acceptance of In-School Mitigation

In univariate multilevel logistic regression models, among the parent and child characteristics, acceptance of COVID-19 mitigation strategies was positively correlated with a child identified as Black (as compared to reference group of White, OR: 2.5, 95% CI: 1.5, 4.1), parent's trust in school (OR: 3.4, 95% CI: 2.3, 5.0), parent's vaccination status (OR: 2.4, 95% CI: 1.5, 3.7) and a parent who identified as either a Democrat or Independent (as compared to reference group of Republican, OR: 4.2, 95% CI: 2.6, 6.7; OR: 2.2, 95% CI: 1.3, 3.8, respectively). Acceptance was also positively correlated with parents' broad support for mitigation (OR: 10.2, 95% CI: 5.3, 19.4). Conversely, acceptance of COVID-19 mitigation strategies was negatively correlated with a child being in middle school (OR: 0.68, 95% CI: 0.48, 0.98; Table 4).

Family, School, & Community Factors Associated with Acceptance of In-School Mitigation

Acceptance of COVID-19 mitigation strategies was positively correlated with school mitigation score (OR: 1.1, 95% CI: 1.0, 1.1), school communication about COVID-19 (OR: 1.7, 95% CI: 1.4, 1.9), and school ability to address COVID-19 (OR: 1.9, 95% CI: 1.5, 2.4). Acceptance of in-school mitigation was not significantly correlated with any of the community level factors in this study.

Discussion

We employed the social ecological model as a framework to examine multiple levels of influence on parents' support for in-school COVID-19 mitigation strategies. This socioecological approach has been used to explain the complex determinants of behaviors such as healthy eating in schools (Townsend & Foster, 2013) and COVID-19 vaccination (Al-Jayyousi et al., 2021). Here, we aimed to consider the range of factors from the parent to the community level that may shape acceptance of in-school COVID-19 mitigation strategies. We found that parents' political affiliation and children's racial identity were strongly correlated with their support for in-school mitigation. Parents who identified as Democrat or Independent and those who identified their child as Black were much more likely to be accepting of COVID-19 mitigation strategies. These findings are consistent with

prior studies that broadly investigated attitudes about COVID-19 mitigation in the general population (Gollust et al., 2020; Hearne & Niño, 2022; Kahane, 2021; Meghani et al., 2022; Viskupič & Wiltse, 2022), as well as studies specifically focused on parents (Gilbert et al., 2020).

Parents' positive opinions about mitigation strategies overall were closely related to their confidence in their child's school's ability to protect in-person learning. Our results suggest that parents may weigh the benefits and risks of in-school mitigation and may be willing to trade off their personal preferences about mitigation for benefits to their child and family (e.g., return to work, social support, and peer interactions that come with in-person instruction). We also found that parents' perceptions of their child's school's ability to communicate and implement mitigation strategies and their trust in the school were robustly associated with their support for mitigation, overall.

These results emphasize the role of schools as important public health agents. Throughout the COVID-19 pandemic, organizations such as the CDC and American Academy of Pediatrics (AAP) called upon schools to be part of the public health response (American Academy of Pediatrics, 2022; Centers for Disease Control and Prevention (CDC), 2022b) providing schools with different and specific guidance for how to stop community spread (Centers for Disease Control and Prevention, 2022a). Additionally, schools are seen as crucial public health agents for improving in another, related public health issue: student mental health (Yu et al., 2022). Our findings highlight how schools may be important agents for not only implementing public health guidance, but for shaping community perceptions of such guidance, as well.

The lack of association we observed between community characteristics like child opportunity and community viral levels with parental acceptance of in-school mitigation may be partly a result of our sample. Because we focused on school districts in Maryland with a high proportion of families in poverty and those from historically excluded racial/ethnic groups, some of these community characteristics were less variable than they would have been in, for example, a national sample. One study, using data from the National School COVID-19 Prevention Study, found that school-based COVID-19 mitigation strategies (restricted to types of ventilation) varied by school urbanicity (i.e., city, suburb, town, rural) and poverty, both of which are community-level factors (Pampati et al., 2022). While this study did not investigate parent perceptions of such strategies, schools in our sample may have differed in their mitigation strategy implementation, which may have affected parent perceptions. This would be consistent with our finding that school mitigation score was correlated with parental acceptance.

Limitations

Our findings should be viewed in light of some limitations. First, our sample includes parents in 8 counties in Maryland, therefore, the results may not generalize to other communities. In addition, we had limited data on in-school mitigation practices. We relied on county-level published policies about mitigation, but the implementation of those policies is likely to vary from school to school and we were not able to capture the extent to which a child's school implemented mitigation strategies with fidelity. Additionally,

specific information about teachers (parental trust, teacher-specific adherence to mitigation strategies, etc.) was not in the purview of the PACE survey but may well be a key factor in a parent's overall opinions of and trust in a school. The role of teachers in parents' acceptance of in-school mitigation strategies would be an area for further study. Finally, the survey was implemented between January and July 2022. In sensitivity analyses, we did not see evidence of systematic changes in acceptance of mitigation over time, but secular trends and changing pandemic conditions may have influenced our results.

Implications for Policy and Practice

This study investigated factors that shape parents' acceptance of in-school COVID-19 mitigation strategies and provides important insight into strategies to marshal support for future in-school public health measures. Schools took on critical new roles in the COVID-19 pandemic as extensions of the public health system. This new scope of work, which, for many schools, included new cleaning, ventilation, contact tracing, distancing, testing, and quarantine policies, was accompanied by the need to communicate and seek support from parents and caregivers in a shifting landscape of policies and best practices. Our results suggest that parents may be willing to accept school mitigation strategies that are not aligned with their personal preferences to facilitate in-person learning. Personal risk, such as having a COVID-19 vulnerable family member, may mean less to a parent than the school's ability to function and resume some semblance of normalcy. Schools that were perceived as able to effectively implement and communicate about their chosen mitigation strategies were more likely to garner parents' support. This suggests that, in future public emergencies, public health professionals should focus on building schools' capacity to implement public health guidance and communicate clearly about the rationale for this guidance to maximize support for health protective policies. Schools are unique, important, and influential public health actors, and thus, they can play a key role in shaping community public health outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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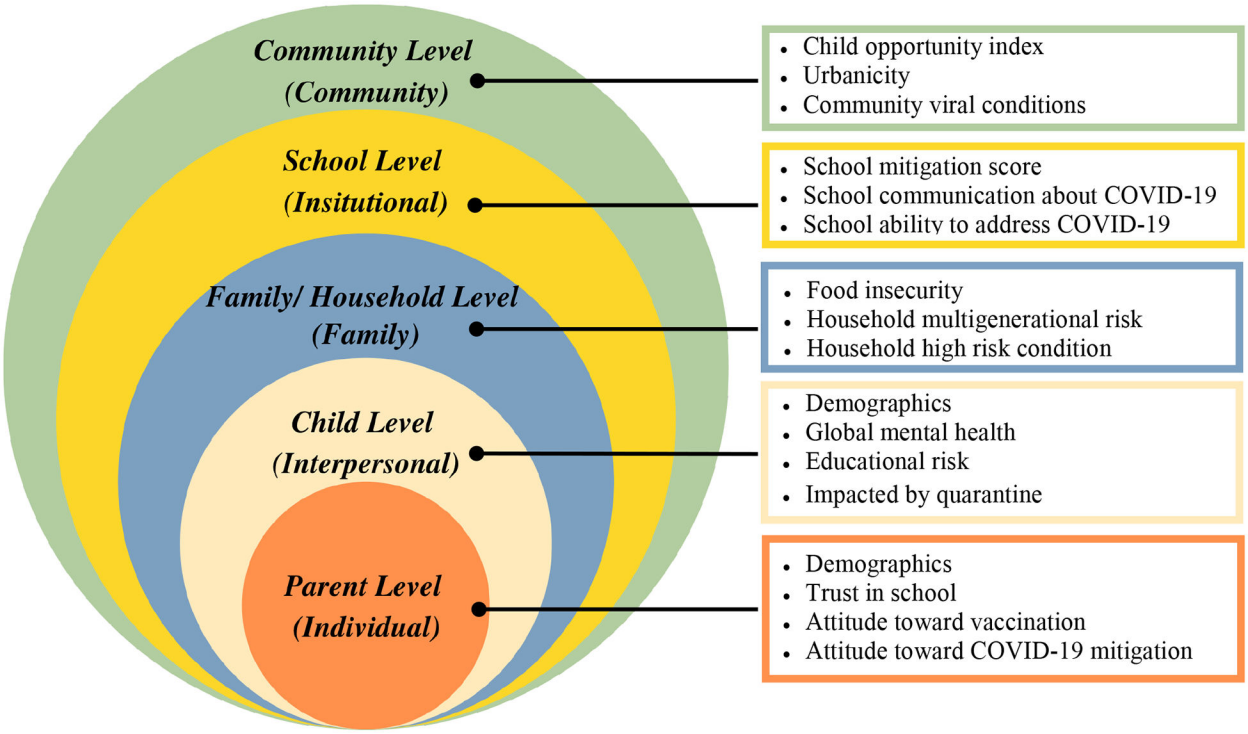

Figure 1.
Social Ecological Model: Factors Influencing Parents' Attitudes about in-School COVID-19 Mitigation Strategies

Table 1:

COVID-19 Mitigation Strategies Assessed

	Mitigation Strategies
1.	Student and/or parent education about COVID-19 and how it spreads
2.	Proper ventilation throughout the school building
3.	Frequent cleaning of surfaces
4.	Policies or structures to encourage regular hand washing or sanitizing
5.	Social distancing between students and between students and staff in classrooms
6.	Social distancing between students in the cafeteria or while eating
7.	Ensuring the same students are together for the majority of the day (in pods or cohorts)
8.	Masking/face covering inside school buildings-classrooms
9.	Masking /face covering inside school buildings-hallways
10.	Masking/face covering while participating in physical education class, band, orchestra, dance, chorus, etc.
11.	Masking/face covering on buses
12.	Masking/face covering while participating in school sports
13.	Masking/face covering while participating in after-school clubs (student government, math club, chess club, etc.)
14.	Regularly testing students at school who don’t have symptoms of COVID-19 (pooled or individual testing)
15.	Contact tracing when a student tests positive
16.	In-school testing when a student has symptoms
17.	Quarantining after exposure (keeping student home from school for a specified number of days)
18.	Proof of negative test after exposure to return to school
19.	Requiring all staff to be vaccinated
20.	Requiring all eligible students to be vaccinated
21.	Requiring all eligible students to be vaccinated to participate in extracurricular activities (athletics, marching band, etc.)
22.	School or school district temporarily moving from in-person to remote learning

Table 2

Social Ecological Correlate Measures

Community level *(Community)*	Child Opportunity Index	2015 Child Opportunity Index: nationally-normed overall scores for 2020 zip codes. Scores could range from 1 to 100, with higher scores corresponding to greater opportunity (diversitydatakids.org, 2020; Noelke et al., 2020)
	Urbanicity	Residential zip code was categorized using the 2010 Rural-Urban Commuting Area (RUCA) Codes. Zip codes were then dichotomized into urban/rural according to Categorization C as specified by the WWAMI Rural Health Research Center (USDA, 2020; WWAMI, 2005)
	Community viral conditions	Calculated by dividing cumulative COVID-19 cases in a county (from March 2020 through January 2022) by the county population (Maryland Counties: Population, 2022; Maryland.gov, 2021)
School level *(Institutional)*	School mitigation score	Score based on qualitative content analysis of school districts' written plans: whether plans included each of the 22 common COVID-19 mitigation strategies in Table 1 (0=not mentioned, 1= encouraged but not mandated, 2=required; range 0 to 42)
	School communication about COVID-19	Scale based on sum of positive responses to three questions: 1) "I know what steps my child's school is taking to keep students safe from COVID-19", 2) "I am satisfied with the communication I've received about COVID-19 at my child's school," and 3) "The information I received from my child's school was easy for me to understand." (1=yes, 0=no; range 0 to 3)
	School ability to address COVID-19	Scale based on sum of positive responses to two questions: "I have confidence in the ability of our school leadership to address this situation appropriately" and "I know who to reach out to if I have questions or concerns about COVID-19 at my child's school." Scores ranged from 0–2 with higher scores indicating better ability to address COVID-19 (1=yes, 0=no; range 0 to 2).
Family/Household level *(Family)*	Food insecurity	Scale based on sum of positive responses to two questions (Hunger VitalSign), "We worried whether our food would run out before we got money to buy more," and "The food that we bought just didn't last, and we didn't have money to get more." (1=yes, 0=no; range 0 to 2). (Hager et al., 2010) *
	Household multigenerational risk	Family with 3+ generations living in home (Yes/No)
	Household high risk condition	Positive response to, "Does anyone in your household have a health condition that puts them at risk for severe COVID-19 disease?" (Yes/No) *
Child level *(Interpersonal)*	Demographics	Race, ethnicity, sex, preferred language, grade in school (NIH CDEs) *
	Global mental health	In general, how is [child]'s mental or emotional health? (Excellent/Very good/Good vs. Fair/Poor) (Ahmad et al., 2014) *
	Educational risk	Scale based on sum of positive responses to three questions: 1) Whether child has a disability, 2) Whether child has low grades ("mostly Cs" or below) in School, 3) Whether child has missed 10+ days of school (1=yes, 0=no; range 0 to 3) *
	Impacted by quarantine	Unable to attend school in person because of a COVID-related quarantine or closure at least once (Yes/No) *
Parent level *(Individual)*	Demographics	Relationship to child, age, sex, preferred language, education, political party, employment status, health insurance, income, number of people supported by income *
	Trust in school	Positive response to: "Trust in school officials and administrators as messengers" as source for correct information about COVID-19 (A great deal/Somewhat vs. A little/Not at all) *
	Attitude toward COVID-19 vaccination	Parent self-reported COVID-19 vaccination status (vaccinated/not vaccinated) *
	Attitude toward COVID-19 mitigation	Positive answer to the question, "Encourage child to wear a mask while shopping" *

* Indicates NIH RADx-UP Common Data Elements (NIH, 2021)

Table 3

Demographics and Characteristics of Respondents by “Acceptor” Status

Variables		*All*	*Non-Acceptor*	*Acceptor*	*p-value* *
	N	**567**	**203**	**364**	
Child Level Variables					
Child race					<0.001
White		337 (59.4%)	139 (68.5%)	198 (54.4%)	
Black		142 (25.0%)	29 (14.3%)	113 (31.0%)	
Other/Multiple		65 (11.5%)	23 (11.3%)	42 (11.5%)	
UNK/Not Reported		23 (4.1%)	12 (5.9%)	11 (3.0%)	
Child Ethnicity					0.021
Not Hispanic or Latino		465 (82.0%)	167 (82.3%)	298 (81.9%)	
Hispanic or Latino		85 (15.0%)	25 (12.3%)	60 (16.5%)	
Unknown		17 (3.0%)	11 (5.4%)	6 (1.7%)	
Grade in School					0.028
Elementary school		349 (61.7%)	113 (55.7%)	236 (65.0%)	
Middle school		217 (38.3%)	90 (44.3%)	127 (35.0%)	
Child sex at birth					0.52
Male		282 (49.9%)	95 (47.0%)	187 (51.5%)	
Female		279 (49.4%)	105 (52.0%)	174 (47.9%)	
Unknown		4 (0.7%)	2 (1.0%)	2 (0.6%)	
Child is multilingual					0.78
No		495 (87.6%)	178 (88.1%)	317 (87.3%)	
Yes		70 (12.4%)	24 (11.9%)	46 (12.7%)	
Child global mental health					0.35
Excellent/Very good/Good		499 (88.3%)	175 (86.6%)	324 (89.3%)	
Fair/Poor		66 (11.7%)	27 (13.4%)	39 (10.7%)	
Child has a chronic health problem		32 (5.6%)	8 (3.9%)	24 (6.6%)	0.19
Child has disability					0.31
No		528 (93.6%)	191 (95.0%)	337 (92.8%)	
Yes		36 (6.4%)	10 (5.0%)	26 (7.2%)	
Child has low grades in school					0.37
No		468 (84.3%)	165 (82.5%)	303 (85.4%)	
Yes		87 (15.7%)	35 (17.5%)	52 (14.6%)	
Child missed >10 days of school					0.58
No		490 (89.4%)	176 (88.4%)	314 (90.0%)	
Yes		58 (10.6%)	23 (11.6%)	35 (10.0%)	
Impacted by quarantine					0.020
No		214 (37.9%)	63 (31.2%)	151 (41.7%)	
Yes		333 (59.0%)	136 (67.3%)	197 (54.4%)	
Prefer not to answer		11 (2.0%)	2 (1.0%)	9 (2.5%)	

Variables		*All*	*Non-Acceptor*	*Acceptor*	*p-value* *
	N	**567**	**203**	**364**	
Unknown		6 (1.1%)	1 (0.5%)	5 (1.4%)	
Parent Level Variables					
Parent age, mean (SD)		38.8 (6.2%)	38.4 (5.9%)	39.0 (6.4%)	0.60
Parent language					0.52
English		167 (96.0%)	68 (97.1%)	99 (95.2%)	
Spanish		7 (4.0%)	2 (2.9%)	5 (4.8%)	
Parent/respondent sex at birth					0.52
Male		144 (25.4%)	48 (23.8%)	96 (26.4%)	
Female		418 (73.9%)	152 (75.2%)	266 (73.1%)	
None of these describe me		1 (0.2%)	0 (0.0%)	1 (0.3%)	
Prefer not to answer		3 (0.5%)	2 (1.0%)	1 (0.3%)	
Parent education					0.46
High school or less		142 (25.1%)	47 (23.3%)	95 (26.1%)	
More than high school		424 (74.9%)	155 (76.7%)	269 (73.9%)	
Parent political party					<0.001
Republican		155 (27.4%)	87 (43.1%)	68 (18.7%)	
Democrat		191 (33.7%)	44 (21.8%)	147 (40.4%)	
Independent		97 (17.1%)	35 (17.3%)	62 (17.0%)	
Other/Refused/Don't know		124 (21.9%)	37 (18.2%)	87 (23.9%)	
Parent employment status					0.68
Unemployed/disability/NA		140 (24.7%)	52 (25.7%)	88 (24.2%)	
Employed		426 (75.3%)	150 (74.3%)	276 (75.8%)	
Parent insurance					0.50
Private		328 (57.8%)	119 (58.6%)	209 (57.4%)	
Public		189 (33.3%)	68 (33.5%)	121 (33.2%)	
No insurance		35 (6.2%)	9 (4.4%)	26 (7.1%)	
DK/Prefer not to answer		15 (2.6%)	7 (3.4%)	8 (2.2%)	
Parent income					0.49
Less than $25,000		91 (16.1%)	27 (13.4%)	64 (17.6%)	
$25,000 – $49,999		126 (22.3%)	48 (23.8%)	78 (21.4%)	
$50,000 – $99,999		197 (34.8%)	68 (33.7%)	129 (35.4%)	
$100,000 and above		112 (19.8%)	41 (20.3%)	71 (19.5%)	
Prefer not to answer		40 (7.1%)	18 (8.9%)	22 (6.0%)	
Number of people supported by parent income, mean (SD)		3.8 (1.3)	4.0 (1.2)	3.7 (1.4)	0.025
Parent relationship to child					0.78
Parent		527 (93.1%)	189 (93.6%)	338 (92.9%)	
Grandparent		22 (3.9%)	6 (3.0%)	16 (4.4%)	
Other relative/guardian		17 (3.0%)	7 (3.5%)	10 (2.8%)	
Parent trust in school					<0.001
No		186 (32.9%)	102 (50.2%)	84 (23.2%)	

Variables		*All*	*Non-Acceptor*	*Acceptor*	*p-value* *
	N	**567**	**203**	**364**	
Yes		365 (64.6%)	93 (45.8%)	272 (75.1%)	
DK		14 (2.5%)	8 (3.9%)	6 (1.7%)	
Parent received COVID-19 vaccine					<0.001
No		110 (19.5%)	57 (28.1%)	53 (14.7%)	
Yes		435 (77.1%)	138 (68.0%)	297 (82.3%)	
Prefer not to answer		19 (3.4%)	8 (3.9%)	11 (3.0%)	
Parent supportive of mitigation					<0.001
No		69 (12.3%)	56 (27.9%)	13 (3.6%)	
Yes		488 (87.0%)	144 (71.6%)	344 (95.6%)	
Prefer not to answer		4 (0.7%)	1 (0.5%)	3 (0.8%)	
Family Level Variables					
Family food insecurity, mean (SD)		0.68 (0.89)	0.73 (0.91)	0.66 (0.88)	0.35
Multigenerational household		50 (8.9%)	19 (9.4%)	31 (8.6%)	0.74
High risk condition in household		198 (34.9%)	77 (37.9%)	121 (33.2%)	0.26
School Level Variables					
School mitigation score, mean (SD)		24.5 (5.0)	23.6 (4.9)	25.0 (5.0)	0.001
School communication about COVID, mean (SD)		2.1 (1.2)	1.7 (1.2)	2.3 (1.0)	<0.001
School ability to address COVID, mean (SD)		1.3 (0.8)	1.1 (0.8)	1.5 (0.7)	<0.001
Community Level Variables					
Community: COI Score, mean (SD)		34.5 (19.1)	36.9 (19.1)	33.2 (19.0)	0.03
Community: Urbanicity					0.45
Urban		486 (85.7%)	171 (84.2%)	315 (86.5%)	
Rural		81 (14.3%)	32 (15.8%)	49 (13.5%)	
Community: Cumulative COVID prevalence, mean (SD)		0.17 (0.02)	0.17 (0.02)	0.17 (0.02)	0.61

* p values were calculated using Pearson chi-squared test for categorical variables and Student's t test for continuous variables.

Table 4:

Socioecological Factors Associated with "Acceptor" Status from Univariate Multilevel Logistic Regression Analysis. (Responses are nested withing county/school district level to account for clustering).

	Odds Ratio	95% CI		p value
Child Level Variables				
Child race				
White	Ref			
Black	2.522	1.534	4.147	<0.001
Other/Multiple	1.213	0.685	2.146	0.508
Unknown/Not Reported	0.597	0.250	1.429	0.247
Child Ethnicity				
Not Hispanic or Latino	Ref			
Hispanic or Latino	1.146	0.671	1.955	0.618
Unknown	0.297	0.106	0.830	0.021
Child sex at birth				
Male	Ref			
Female	0.851	0.599	1.209	0.367
Unknown	0.543	0.074	4.012	0.550
Child is multilingual				
No	Ref			
Yes	0.887	0.507	1.550	0.674
Grade in School				
Elementary school	Ref			
Middle school	0.681	0.476	0.974	0.035
Child global mental health				
Excellent/Very good/Good	Ref			
Fair/Poor	0.806	0.473	1.374	0.429
Child has a chronic health problem	1.750	0.762	4.019	0.187
Child has disability				
No	Ref			
Yes	1.414	0.662	3.022	0.371
Child has low grades in school				
No	Ref			
Yes	0.738	0.456	1.193	0.215
Child missed >10 days of school				
No	Ref			
Yes	0.744	0.417	1.328	0.317
Impacted by quarantine				
No	Ref			
Yes	0.560	0.383	0.820	0.003
Prefer not to answer	1.384	0.283	6.761	0.688
Unknown	1.788	0.197	16.230	0.605

	Odds Ratio	95% CI		p value
Parent Level Variables				
Age	0.026	−0.044	0.096	0.469
Parent/respondent sex at birth				
Male	Ref			
Female	0.913	0.608	1.371	0.662
None of these describe me	1.000			
Prefer not to answer	0.262	0.023	3.045	0.284
Parent language				
English	Ref			
Spanish	1.185	0.197	7.124	0.853
Parent education				
High school or less	Ref			
More than high school	0.973	0.637	1.487	0.900
Parent political party				
Republican	Ref			
Democrat	4.126	2.563	6.642	<0.001
Independent	2.221	1.309	3.769	0.003
Other/Refused/Don't know	2.959	1.783	4.909	<0.001
Parent employment status				
Unemployed/disability/NA	Ref			
Employed	1.160	0.770	1.745	0.478
Parent insurance				
Private	Ref			
Public	0.937	0.637	1.378	0.741
No insurance	1.253	0.545	2.882	0.596
DK/Prefer not to answer	0.567	0.197	1.636	0.294
Parent income				
Less than $25,000	Ref			
$25,000 – $49,999	0.741	0.412	1.334	0.318
$50,000 – $99,999	0.931	0.531	1.631	0.802
$100,000 and above	0.865	0.466	1.609	0.648
Prefer not to answer	0.570	0.260	1.246	0.159
Number of people supported by parent income	0.860	0.751	0.984	0.028
Parent relationship to child				
Parent	Ref			
Grandparent	1.686	0.636	4.472	0.294
Other relative/guardian	0.713	0.261	1.947	0.510
Parent trust in school				
No	Ref			
Yes	3.423	2.342	5.003	<0.001
DK	0.900	0.297	2.728	0.852
Parent received COVID-19 vaccine				

	Odds Ratio	95% CI		p value
No	Ref			
Yes	2.373	1.537	3.662	<0.001
Prefer not to answer	1.613	0.591	4.401	0.351
Parent supportive of mitigation				
No	Ref			
Yes	10.162	5.321	19.406	<0.001
Prefer not to answer	12.717	1.213	133.367	0.034
Family Level Variables				
Family food insecurity				
No	Ref			
Yes	0.873	0.716	1.065	0.181
Multigenerational household				
No	Ref			
Yes	0.891	0.481	1.650	0.714
High risk condition in household				
No	Ref			
Yes	0.798	0.554	1.150	0.225
School Level Variables				
School mitigation score	1.062	1.016	1.110	0.008
School communication about COVID	1.653	1.416	1.930	<0.001
School ability to address COVID	1.932	1.539	2.426	<0.001
Community Level Variables				
Community: COI Score	0.991	0.980	1.001	0.083
Community: Urbanicity				
Urban	Ref			
Rural	0.926	0.495	1.732	0.810
Community: Cumulative COVID prevalence	2.640	0.000	717502 9.000	0.898