Utility and Acceptability of Rapid Antigen Testing for Influenza and SARS-CoV-2 in K-12 School Health Offices During and After the COVID-19 Pandemic

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ABSTRACT

Background: Kindergarten through 12th grade (K-12) schools are potential hotspots for infectious disease transmission. We used test results and feedback from school health staff and parents to assess in-school rapid testing during and after the COVID-19 pandemic.

Methods: Rapid testing was conducted in seven K-12 schools during 2021 to 2024. Sofia2-FIA (fluorescent immunoassay) analyzers, test kits, training, and troubleshooting services were provided. School health staff feedback surveys were distributed each year. Parent feedback was collected during the 2023-2024 school year.

Results: Across 3 years, 1710 rapid tests were performed. SARS-CoV-2 (n = 126) and influenza A/B (n = 105) were detected. School health staff found rapid testing "easy" to "very easy" (97%) and supported continuation (90.9%). Parents reported feeling "very relieved" (42.1%) following testing.

Discussion: Rapid testing was highly utilized during and after the COVID-19 pandemic and was well-received by school health staff and parents.

BACKGROUND

Kindergarten through 12th grade (K–12) schools are characterized by high levels of social interaction and close contact, making them potential hotspots for infectious disease transmission. The K–12 school calendar has been linked to outbreaks of acute respiratory infections across the broader community, thus underscoring the role of early detection within schools.[1]

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The dilemma of preserving educational continuity while implementing mitigation strategies to reduce disease transmission during the COVID-19 pandemic provided the opportunity to introduce rapid antigen tests (RAT) for respiratory pathogens into school settings.[2,3] To navigate the return to in-person learning, some schools implemented testing using RAT to quickly identify and isolate positive cases. Here, we summarize how a school district in Wisconsin utilized school-administered RAT during and after the COVID-19 pandemic. By sharing insights from school health staff and participants, we demonstrate the utility of RAT as an accessible and timely strategy for mitigating respiratory virus transmission in schools.

METHODS

Rapid testing was conducted in the Oregon School District (OSD), where our University of Wisconsin-Madison (UW) research team (hereafter known as the research team) has conducted school-based respiratory disease surveillance since 2015. The OSD is located in South-Central Wisconsin and includes 3 elementary schools (K–4), 1 expanded elementary school (K–6), 1 intermediate school (5–6), 1 middle school (7–8), and 1 high school (9–12), serving over 4000 K–12 students.

In September 2021, we supplied Sofia2 Fluorescent Immunoassay (FIA) analyzers equipped with wireless reporting capability and test kits to OSD schools.[4] This initiative was in conjunction with the Wisconsin Department of Health Services (DHS) during the 2021–2022 school year; the research team contributed consultation, annual training for school health staff on testing and specimen collection, and technical support services

during all 3 school years. The program was solely supported by the research team during the 2022-2023 and 2023-2024 school years. Testing supplies and analyzers were provided by DHS in year 1 and QuidelOrtho (QuidelOrtho Corporation; San Diego, California) in years 2 to 3.

Students presenting to health offices with 2 or more respiratory symptoms (Appendix A) were eligible for RAT by school health staff. Parental consent was obtained during school registration at the beginning of each academic year. Students who received rapid testing were given a printed result to be shared with a parent/guardian. Deidentified RAT results were transmitted wirelessly to the Virena system for export and analysis.[5]

School Health Staff Feedback Surveys

In Spring 2022, we developed a quality improvement survey to assess school health staff's knowledge and experience with Sofia2-FIA analyzer technology and swab collection, and to obtain feedback on the feasibility, acceptability, and generalizability of RAT in school health workflows (Appendix B). Surveys were distributed via email in spring 2022, 2023, and 2024 using Qualtrics XM (Qualtrics; Utah).

Parent Feedback Surveys

In fall 2023, we developed a feedback survey for parents who (1) consented to their children receiving a rapid test, and (2) had a student who received rapid testing at school, to assess their experience with the RAT program (Appendix B). Surveys were distributed weekly by OSD office staff to parents/guardians whose children had received RAT the previous week. Surveys assessed perceived benefits, harms, satisfaction, and acceptability of rapid testing in schools. Individuals who completed the survey were entered into a drawing to win a $50 gift card as an incentive. Surveys were developed and distributed using REDCap electronic data capture tools hosted at the University of Wisconsin–Madison.[6]

Analysis

We utilized descriptive statistics to evaluate the rates of participation, percent positivity of RAT in schools during and after the pandemic, and responses to health office and parent surveys. Qualitative coding of school health staff and parent surveys was performed independently by 4 research team members, and codes were generated and categorized into themes based on thematic analysis. Coders met regularly to ensure consensus of themes and shared understanding of supporting evidence.

RESULTS

Rapid Testing in Schools

From September 1, 2021, through June 7, 2024, school health staff completed 1710 RATs. Of these, 220 (12.9%) were positive, 1482 (86.7%) were negative, and 8 (0.5%) were invalid (Table 1). Most tests were run during the 2021-2022 school year (n = 226, 71.7%), and similar temporal patterns were observed across all 3 years, with a primary testing peak during December to January, followed by a smaller peak during March to May (Figure). Although the high school completed the highest number of tests among the 7 schools (n = 425), grades K-4 collectively conducted the most rapid testing (n = 530). SARS-CoV-2 accounted for 57.3% of detections across all schools and years.

Table 1. Summary Results From Rapid Testing During Academic Years 2021–2022, 2022–2023, and 2023–2024 Across Seven K–12 Schools in the Oregon School District, Dane County, Wisconsin

	2021–2022	2022–2023	2023–2024	Total
Total tests, n	1226	302	182	1710
Positive, n (%)	152 (12.4)	49 (16.2)	19 (10.4)	220 (12.9)
Influenza A, n (%)	35[a] (23)	27 (55.1)	11[c] (57.9)	73 (33.2)
Influenza B, n (%)	20 (13.2)	9[b] (18.4)	3[d] (15.8)	32 (14.5)
SARS-CoV-2, n (%)	103 (67.8)	16 (32.7)	7 (36.8)	126 (57.3)
Negative, n (%)	1068 (87.1)	251 (83.1)	163 (89.6)	1482 (86.7)
Invalid, n (%)	6 (0.5)	2 (0.7)	0	8 (0.5)
Schools, Grades	**Tests Run**	**Influenza A**	**Influenza B**	**SARS-CoV-2**
Elementary 1, K–4	143	6	1	7
Elementary 2, K–4	267	16	7	19
Elementary 3, K–4	120	6	1	11
Elementary 4, K–6	282	7	7	15
Intermediate, 5–6	298	11	11	25
Middle School, 7–8	175	11	3	19
High School, 9–12	425	16	2	30

[a]6 co-detections of influenza A + SARS-CoV-2.
[b]3 co-detections of influenza B + SARS-CoV-2.
[c]1 co-detection of influenza A + SARS-CoV-2.
[d]1 co-detection of influenza B + SARS-CoV-2.

School Health Staff Feedback Surveys

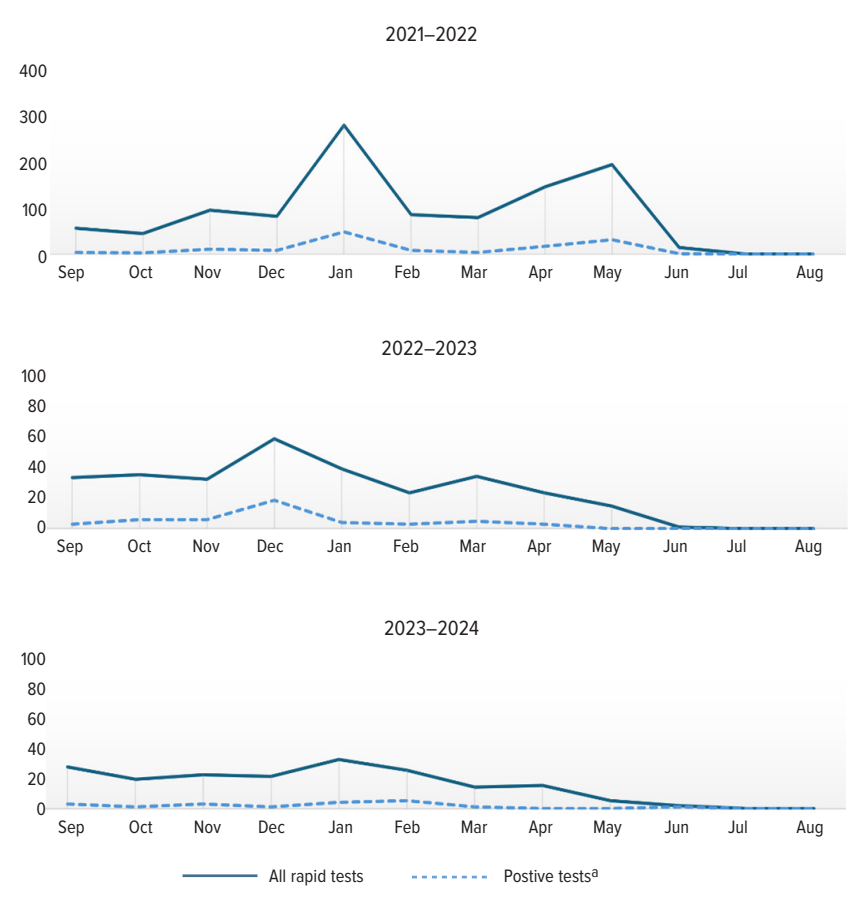
In 2022, 2023, and 2024, 13 out of 13, 11 out of 11, and 9 out of 10 school health staff completed the annual feedback surveys, respectively. Seven school health staff members were OSD employees throughout the testing period and completed the survey all 3 years. After receiving 1 initial training in 2021, staff responses about confidence in performing a RAT changed from "not confident at all" (n = 10, 76.9%) to "very confident" (n = 11, 84.6%). Many staff (54.5%) utilized Sofia2-FIA troubleshooting services offered by the research team. In all 3 years, staff found RAT to be "very easy" or "easy" (97%) and wanted to continue its use (90.9%). Health staff confidence in the accuracy of the RAT result averaged 4.28 on a Likert scale of 1 (low) to 5 (high) over all 3 years. Staff expressed appreciation for the ability to conduct rapid testing, while recognizing time constraints and the need for a more streamlined testing process. Staff underscored the usefulness of being able to test themselves and fellow coworkers when needed. Related themes, codes, and survey questions are documented in Table 2 and the respective legend.

Parent Feedback Surveys

During September 2023 through April 2024, a total of 38/85

(44.7%) surveys were completed by OSD parents whose children received rapid testing. Parents reported feeling grateful for access to this service at school and feeling "very relieved" (n = 16, 42.1%) after their child received a RAT result in school, "very satisfied" (n = 28, 73.7%) with the information/resources received from the school health office, and "very satisfied" (n = 32, 84.2%) with the speed test results were obtained and communicated.

Figure. Monthly Rapid Antigen Tests Performed and Positive Rapid Antigen Tests During Three Consecutive School Years



[a]Positive tests include SARS-CoV-2, influenza A and influenza B combined.

DISCUSSION

Early detection of COVID-19 and influenza in children is crucial for mitigating disease transmission in congregate settings such as schools. Within the OSD, the use of RAT in K-12 schools during and after the COVID-19 pandemic was feasible to implement and widely accepted by school health staff and parents. The opportunity to continue rapid testing in schools was met with positive feedback from both school health staff and families who consented to school-administered RAT.

The number of RATs performed at school decreased each year. This may be due to districtwide mandates in place during the 2021-2022 academic year that required stricter testing, with fewer tests performed as mandates were lifted and during post-pandemic conditions. This also may be attributed to increased accessibility of at-home rapid tests over time and waning concern about the pandemic.

Rapid testing was well-received by school health staff, most of whom were highly confident in RAT results and elected to continue the program in the following years. Surveyed parents also reported high levels of relief when their child received a RAT, which did not vary significantly based on test results. These findings are consistent with other studies demonstrating increased parental and staff peace of mind associated with school-based testing.[7]

This evaluation had several limitations. First, this evaluation was a post-hoc assessment of a community service program. Second, although Sofia2-FIA analyzers were introduced to monitor acute respiratory infection activity among K-12 students, staff were able to obtain rapid testing if they were symptomatic at school. Because analyzers do not label results with students or staff, we can only distinguish an individual as staff or student based on age (>18 years as staff, <18 years as student). In this assessment, we included results of RATs performed on all ages to encompass real-life experiences with RAT in K-12 settings. Third, students and families were required to sign waivers to participate in school RAT and could only be tested if they were symptomatic. Thus, this study excluded asymptomatic or unconsented individuals and may underestimate the true prevalence of influenza and COVID-19 in this population. Lastly, generalizability may be limited due to selection bias of the parent subgroup surveyed, small sample size, and suboptimal response rates from the parent feedback survey, our preexisting relationship with the school district, and the racial/ethnic homogeneity of OSD.[1]

This analysis also has notable strengths, namely the use of quantitative and qualitative approaches to assess feasibility and utility of the RAT platform and acceptance of the program by school health staff and participating parents. School-based testing initiatives can broaden access to rapid testing for school-aged children and contribute to a safer learning environment.[8] While a positive test may affect families by introducing the logistical and financial burden of extra childcare, systematic rapid testing protocols have the potential to reduce overall disease transmission and related absences for students and staff.[9,10] This program was widely utilized and well-received by those surveyed, and sig-

Table 2. Common Themes and Related Codes From School Health Office Staff and Parent Surveys

Theme	Codes	No. of Comments		Example Quotes
		Staff (n=33)	Parents (n=38)	
Rapid testing as a useful resource	Beneficial for both students and staff	11	6	"I very much appreciated the rapid testing as a tool…" (staff)
	Invaluable resource for families			"This resource has also been invaluable to provide a test to those families that it would have been too overwhelming to navigate scheduling a COVID test." (staff)
	Appreciation for access to testing			"Grateful for this service." (parent)
	Helpful, useful tool			"I really appreciate the ability to test at school so I don't have to make a separate doctor appointment." (parent)
Rapid testing as an important tool for school staff	School staff save time by testing at school instead of going elsewhere for testing	13	N/A	"I used [testing] when needed and felt more confident when taking care of students knowing my tests were negative." (staff)
	Staff felt better taking care of students when they were able to test themselves			"I appreciated having the option to test myself if I had a known/ suspected exposure or having symptoms." (staff)
	Faster alternative to making an appointment for a COVID test			"It was reassuring for school staff that they didn't have flu/ COVID, which is easy to spread." (staff)
	Beneficial resource for health office staff and other teachers			"This was so helpful for staff and myself, quick and easy." (staff)
Testing required extra time, resources, and support	Support for testing dependent on staffing availability	11	N/A	"…hard for health room staff to manage testing and a busy health office at the same time." (staff)
	Testing process could be time-consuming			"Slightly time-consuming." (staff)
	Difficult to manage testing during busy times for health office staff			"It was kind of a hassle to get staff tested in between other things going on in the health office." (staff)
	Testing, consenting, and information input could be more streamlined			"Get more families to sign waivers ahead of time." (staff)

[a]A majority (8/11) of responses related to the theme "Testing required extra time, resources, and support" were collected during Year 1, when school health nurses were required to report COVID testing through a state-operated system called COVID Connect, which could anecdotally be time-consuming and cumbersome.

Qualitative responses from school health office staff were collected for 2 short-answer questions: (1) "What are your thoughts on using rapid testing on yourself and/or other school staff?" (2) "Do you have any suggestions on how to improve implementation of rapid testing in a school health office setting?" Qualitative responses from parents were collected from the short-answer question: "How could your family's experience with rapid testing in school be improved? Do you have any questions, or is there any information/resources you would have liked to receive?"

nificant pathogens were effectively detected among participants. Longitudinal testing in more and diverse academic environments may provide additional evidence for the generalizability of such a program in other school districts.

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Appendices: Available at www.wmjonline.org

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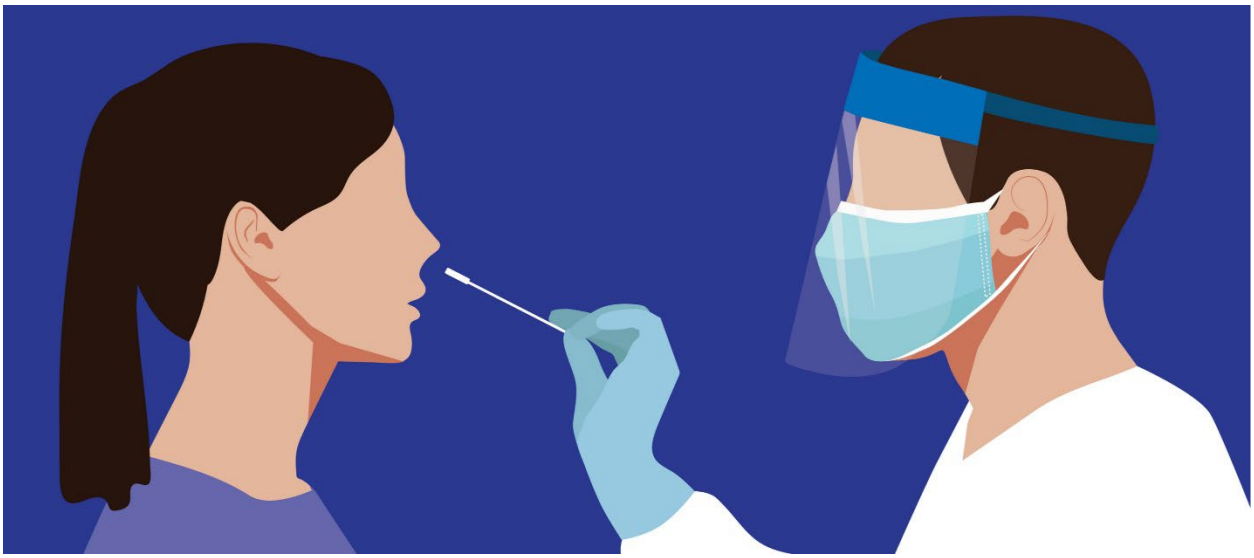
Appendix A: Rapid Antigen Testing Recruitment Criteria

SARS+FLU TESTING CRITERIA



Specimens for antigen testing should only be collected from consented students with **at least 2** of the following symptoms:

FEVER

CHILLS

COUGH

SHORTNESS OF BREATH OR DIFFICULTY BREATHING

FATIGUE

MUSCLE OR BODY ACHES

HEADACHE

NEW LOSS OF TASTE OR SMELL

SORE THROAT

CONGESTION OR RUNNY NOSE

NAUSEA OR VOMITING

DIARRHEA

Appendix B: School Health Staff Survey and Parent Survey

General Knowledge

How confident are you in your ability to do the following:

	Not confident at all	Slightly confident	Somewhat confident	Fairly confident	Very confident
Identify COVID-like symptoms	○	○	○	○	○
Collect a nasal swab	○	○	○	○	○
Perform a SOFIA rapid test	○	○	○	○	○
Report test results to parent	○	○	○	○	○

Please rate the level of effectiveness of the following techniques to mitigate the spread of COVID and influenza-like illnesses:

	Not at all effective	Slightly effective	Somewhat effective	Fairly effective	Very effective
In-school rapid testing	○	○	○	○	○
Staying home when sick with a flu-like illness	○	○	○	○	○
Isolating at home when SARS-CoV-2 positive	○	○	○	○	○
Quarantining if exposed to SARS-CoV-2	○	○	○	○	○

SOFIA rapid testing

Please think about your experience with **SOFIA rapid testing** when answering the following questions.

How helpful was in-person training?

Not at all helpful	Slightly helpful	Somewhat helpful	Fairly helpful	Very helpful	N/A
○	○	○	○	○	○

How easy was it to use SOFIA rapid testing?

Very easy	Easy	Neutral	Difficult	Very difficult	N/A
○	○	○	○	○	○

How easy was it to collect a nasal swab?

Very easy	Easy	Neutral	Difficult	Very difficult	N/A
○	○	○	○	○	○

What problems, if any, did you encounter while using the rapid testing equipment at your school?

Did you need to troubleshoot SOFIA rapid testing issues with ORCHARDS staff?

- ○ Yes
- ○ No

How helpful was troubleshooting assistance?

Not at all helpful	Slightly helpful	Somewhat helpful	Fairly helpful	Very helpful
○	○	○	○	○

How confident were you in the accuracy of the SOFIA rapid test results?

Not at all confident	Slightly confident	Somewhat confident	Fairly confident	Very confident
○	○	○	○	○

How useful was SOFIA rapid testing for detecting cases of COVID-19?

Not at all useful	Slightly useful	Somewhat useful	Fairly useful	Very useful
○	○	○	○	○

How useful was SOFIA rapid testing for detecting cases of Influenza?

Not at all useful	Slightly useful	Somewhat useful	Fairly useful	Very useful
○	○	○	○	○

What are your thoughts on using rapid testing on yourself and/or other school staff?

Would you like to utilize SOFIA rapid testing next year?

- ○ Yes
- ○ No

Do you have any suggestions on how to improve implementation of rapid testing in a school health office setting?

Demographics

What is your age?

Please select your highest level of education.

- ○ No high school diploma
- ○ High school diploma or GED
- ○ Some college, no degree
- ○ Associate degree
- ○ Bachelor's degree
- ○ Master's degree
- ○ Professional or doctorate degree

Please select the race(s) you identify with.

- ☐ White
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ Do not to wish to share
- ☐ Other

Please select the ethnicity you identify with.

- ○ Hispanic
- ○ Non-Hispanic
- ○ Do not wish to share

Which school(s) do you work at?

- ☐ Netherwood Knoll Elementary
- ☐ Prairie View Elementary

- [ ] Forest Edge Elementary
- [ ] Brooklyn Elementary
- [ ] Rome Corners Intermediate
- [ ] Oregon Middle School
- [ ] Oregon High School

Thank you

Thank you for taking the time to share your feedback and experience with the OSD health office rapid testing program!

Parent/Guardian OSD Rapid Testing Evaluation Survey

Survey date

_____

Date of child's rapid test at OSD

_____

Rapid test result

- ☐ Influenza A positive
- ☐ Influenza B positive
- ☐ RSV positive
- ☐ SARS-CoV-2 positive
- ☐ Negative

How did receiving this result make you feel?

- ◯ 5 (very relieved)
- ◯ 4 (relieved)
- ◯ 3 (fairly relieved)
- ◯ 2 (slightly relieved)
- ◯ 1 (not at all relieved)

How do you feel about participating in activities outside of your household after receiving this result?

- ◯ 5 (very cautious)
- ◯ 4 (cautious)
- ◯ 3 (fairly cautious)
- ◯ 2 (slightly cautious)
- ◯ 1 (not at all cautious)

How satisfied were you with the following:

	5 (very satisfied)	4 (satisfied)	3 (fairly satisfied)	2 (slightly satisfied)	1 (not at all satisfied)
Information/resources received from the school health office	◯	◯	◯	◯	◯
Speed with which test result was obtained and communicated to me	◯	◯	◯	◯	◯

Was your child seen by a healthcare provider prior to receiving this rapid test?

- ◯ Yes, virtually
- ◯ Yes, in person
- ◯ No

Where was your child seen?

- ◯ Clinic
- ◯ Urgent care
- ◯ ER
- ◯ Other

Was your child seen by a healthcare provider after receiving this rapid test?

- ◯ Yes, virtually
- ◯ Yes, in person
- ◯ No

Where was your child seen?

- ◯ Clinic
- ◯ Urgent care
- ◯ ER
- ◯ Other

Has your child been vaccinated against influenza this school year (vaccine received after July 1, 2023)?	◯ Yes ◯ No, but intend to ◯ No
Has your child been vaccinated against COVID-19?	◯ Yes, fully vaccinated & one or more boosters ◯ Yes, fully vaccinated ◯ Yes, partially vaccinated ◯ No
When did your child's respiratory symptoms start?	_____
Are your child's symptoms still ongoing?	◯ Yes ◯ No
When did their symptoms end?	_____
Please select all symptoms that you child has been experiencing during this illness:	☐ Fever ☐ Chills ☐ Cough ☐ Wheezing ☐ Runny nose ☐ Sore throat ☐ Fatigue ☐ Muscle pain ☐ Joint pain ☐ Headache ☐ Stuffy Nose ☐ Ear Pain ☐ No appetite ☐ Vomiting ☐ Abdominal Pain ☐ Diarrhea ☐ Conjunctivitis ☐ Shortness of Breath ☐ Loss of Smell ☐ Loss of Taste
Has your child been absent due to this illness?	◯ Yes ◯ No
How many days has your child been absent from school due to this illness?	_____
Has anyone in your household missed work due to this illness (either because of symptoms or caring for someone with symptoms)?	◯ Yes ◯ No
Please list cumulative days of missed work for all household individuals:	_____
Preferred email (to be entered into a drawing for a $50 gift card):	_____ (You will only be contacted if you are selected as a gift card winner.)

How could your family's experience with rapid testing in school be improved? Do you have any questions, or is there any information/resources you would have liked to receive? Please tell us here: