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Brief Report

Disinfectant use by K-12 school staff to combat SARS-CoV-2

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A B S T R A C T

K-12 school staff from Indiana, Kentucky and Ohio were asked about their use of disinfectants to mitigate the spread of COVID-19 in schools. Survey participants (n = 1,555) reported frequent use of disinfectants, often using unknown products, and were provided little to no training on safe and effective use. Participant concerns included student involvement in disinfection, inadequate ventilation, surface contact time, and potential health effects.

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BACKGROUND

Beginning in March 2020, the disease COVID-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), greatly impacted 60 million United States children and school staff involved in K-12 education.¹ To minimize spread of COVID-19 in schools, the Centers for Disease Control and Prevention (CDC) provided recommendations including disinfecting high-touch areas regularly with products on the Environmental Protection Agency (EPA) List N or a bleach solution.^{2,3} Disinfectants that kill SARS-CoV-2 most commonly contain quaternary ammonium (quats), bleach, or peroxide. These products carry the risk of skin and eye irritation, have been associated with asthma and chronic obstructive pulmonary disease (COPD), and contain chemicals linked to reproductive disorders, central nervous system impairment, and cancer.^{4–6} Warning labels on disinfectants state the need for ventilation, gloves, and to keep children away. This

publication reports findings of a survey of teachers and other school staff regarding their cleaning and disinfecting practices at school.

METHODS

To address challenges specific to school staff during COVID-19, a survey was developed in partnership with a School Staff Advisory Board (SSAB). The SSAB convened to inform the survey relating to school staff experiences during restarts, school environment, and specific challenges. In partnership with education associations in Indiana, Kentucky, and Ohio, the electronic Fall 2020 survey was launched in November with an overall focus on school staff health and well-being. The survey was launched through education association listserves which included teachers and education support professionals (ESPs) working in public schools. Survey invitees were encouraged to forward invitations to any school staff regardless of membership. Participation was incentivized by drawings for gift cards. Those completing the survey were sent a unique email link for a follow-up mini-survey to share experiences focused on cleaning and disinfecting while at school. In January 2021, this focused 8-question electronic survey was sent to any consenting participant who indicated being on school premises. Included were questions about products used, frequency, training provided, use of gloves, and health effects. An open-ended question allowed participants to share further. The study was approved by the University of Kentucky's Institutional Review Board.

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Table 1
Disinfectant use by school staff

	Total participants (n = 1555)	Teachers (n = 1266)	Non-teachers (n = 176)
State			
Indiana	483 (31.0%)	406 (32.1%)	44 (25.0%)
Kentucky	144 (9.3%)	119 (9.4%)	16 (9.1%)
Ohio	920 (59.2%)	736 (58.1%)	114 (64.8%)
Other/Not given	8 (0.5%)	5 (0.4%)	2 (1.1%)
Frequency Cleaning and Disinfecting Surfaces at School (n = 1,539)			
Did not clean and disinfect	169 (11.0%)	133 (10.6%)	21 (12.2%)
≤ 1 time/d	260 (16.9%)	216 (17.3%)	26 (15.0%)
2–3 times/d	395 (25.7%)	305 (24.4%)	56 (32.4%)
>4 times/d	712 (46.4%)	597 (47.7%)	70 (40.4%)
Use of disinfectant products (n = 1,163)			
At least one product used could not identify*	699 (60.1%)	578 (60.3%)	79 (60.3%)
At least one product used effective against SARS-CoV-2 [†]	579 (49.8%)	472 (49.2%)	66 (50.4%)
No products used effective against SARS-CoV-2 [†]	38 (3.3%)	32 (3.3%)	4 (3.1%)
Safety Data Sheets provided* (n = 1,326)	325 (24.5%)	260 (23.8%)	37 (25.5%)
Trained on using products safely and effectively* (n = 1,355)	458 (33.8%)	374 (33.7%)	54 (36.2%)
Never wore gloves when applying the product(s)* (n = 1,367)	1070 (78.3%)	889 (79.6%)	107 (70.4%)
Experienced health effects following the use of product(s)			
No	1007 (73.8%)	827 (74.0%)	111 (73.0%)
Don't know	280 (20.5%)	224 (20.1%)	33 (21.7%)
Yes	78 (5.7%)	66 (5.9%)	8 (5.3%)
Eyes burning*	10 (12.8%)	9 (13.6%)	1 (12.5%)
Respiratory/Breathing Issues*	32 (41.0%)	25 (37.9%)	6 (75.0%)
Headache*	30 (38.5%)	25 (37.9%)	3 (37.5%)
Nausea*	8 (10.3%)	5 (7.6%)	2 (25.0%)
Skin irritation*	50 (64.1%)	43 (65.2%)	4 (50.0%)
Other*	9 (11.5%)	7 (10.6%)	1 (12.5%)

Note: Participants did not answer all questions; % is calculated for those who answered each question.

*Based on those reporting. Categories are not mutually exclusive and percentages will not add up to 100%.

[†]Product expected to kill SARS-CoV-2 such as bleach or disinfectant found on EPA List N.

All data were collected using REDCap⁷ and all analyses were performed using SAS v9.4. Descriptive analyses include counts and percentages for each item overall and by profession (teacher vs education support professional).

RESULTS

A total of 10,308 school staff participated in the health and well-being school staff survey. Of these, 4,883 were invited to complete the mini-survey focused on disinfectants. For the disinfectant mini-survey, 1,555 (32%) school staff responded (Table 1; Indiana n = 483, Kentucky n = 144, Ohio n = 920). Of the participating school staff, more than 80% identified as teachers (n = 1,266).

Participants reported disinfecting frequently, with nearly half reporting four or more times and/or day. Of those that reported using disinfectants, the majority (60%) indicated that at least one product was unknown to them, for example, was unlabeled. Only one-third received training on how to use products safely and effectively; 24.5% reported Safety Data Sheets were provided. Nearly 80% did not wear gloves when disinfecting.

Health effects that participants associated with disinfectant use were noted by 6%, with 21% unsure. Of the 6% (n = 78) who reported a health effect, most frequent were skin irritation (64%), respiratory and/or breathing issues (41%), and headaches (38%). Neither students nor parents were surveyed regarding student health effects.

Most participants (n = 986) provided a response to the health effects question and also communicated if they used spray and/or liquid disinfectant only, wipes only, or both. Of those reporting adverse health effects, 69.4% used spray disinfectant only, 4.8% used wipes only and 25.8% used both. Comparatively, of those indicating no health effects, 55.4% used spray only, 15.4% used wipes only, and 29.2% used both; of those who were unsure of health effects, 58.3% used spray only, 9.0% used wipes only, and 32.7% used both.

Many participants (n = 525) shared additional information via the open-ended question. Most used this opportunity to express concerns; only a handful of responses were positive. A representative sample of comments are highlighted in Table 2. Themes include: student participation in disinfecting, ventilation, surface “contact time”,

Table 2
Representative quotes from school staff

Student participation
<i>It says right on the bottle to "keep away from children" yet teachers spray down every desk after each class and students wipe their desk (7 times per day) with cheap paper towels. – High School Teacher</i>
<i>It is up to the teachers and students to clean, and I teach first grade. – First Grade Teacher</i>
Ventilation
<i>I'm in a windowless room, so hoping that breathing the spray every hour will be okay long-term. – Elementary School Teacher</i>
Surface “contact time”
<i>(It) is supposed to be left on the surface for a period of 10 minutes but we are instructed to wipe it off immediately between classes. – High School Teacher</i>
Severity of health outcomes
<i>My classroom seemed to fill with the alcohol fumes after seven periods of cleaning between classes. That night I had continuing vomiting to the point where I went to the ER. – Middle School Teacher</i>
<i>After using products in the classroom, my asthma has been set off and caused two trips to the emergency room. – Elementary School Teacher</i>
Use of unknown products
<i>I honestly have no clue what products we were given but hope it works. – Middle School Teacher</i>
Concern for long-term health impact on staff and students
<i>On the bottle, it says "don't use in food space" but we have to use it to spray the kid's desks before they eat lunch. – Elementary School Teacher</i>
<i>Some days my lungs hurt. I am afraid that someday in the future we will have problems with our lungs because of these products. – Middle School Teacher</i>

severity of health outcomes, use of unknown products, and concern for long-term health impact on staff and students.

DISCUSSION

Teachers and other school staff reported frequent use of disinfectants, most often without training or access to safety information. Half reported use of at least one product that is expected to kill SARS-CoV-2 when used according to the label directions. However, these products have a "contact time," typically 2–10 minutes, during which it must remain wet on the surface in order to be effective. Many teachers reported that the contact time exceeded the time between classes, so the product was wiped up early and therefore less or not effective. In addition, children, who may be particularly vulnerable due to their developing respiratory systems, were involved in disinfecting. Per the CDC, "Disinfection products should not be used by children or near children, and staff should ensure that there is adequate ventilation when using these products to prevent children or themselves from inhaling toxic vapors."⁸ Vapors can remain in the air long after a surface is dry and chemicals such as quats leave residue after drying that can become a long-term exposure pathway via dust, particularly for children.⁹ Schools were given guidance to improve ventilation by opening windows and adjusting their ventilation systems.¹⁰ However, many classrooms don't have windows or windows that open and schools with older systems or limited resources may be unable to provide adequate ventilation and filtration. The frequency of disinfectant usage, proximity of students, and school's potential inability to meet ventilation requirements raise the concern for long-term inhalation health effects for school staff and students. Studies have shown that occupational disinfectant use by nurses and others is a risk factor for asthma and COPD.^{4,6} There is also evidence that children's exposure to cleaning products increases their risk of asthma.⁶ Clearly, a balance needs to be found between infection control and health risks of disinfectant use. As it became more evident that SARS-CoV-2 spreads more easily by air than by surface, the CDC updated its guidance to greatly reduce disinfection. We recommend

that users follow current CDC guidance regarding disinfectant use including frequency, ventilation, gloves, protection of children, and training. In addition, schools should select products found on the EPA List N which have short contact time, provide the label instructions to staff using the product, and encourage staff to follow these instructions. Given the potential long-term health effects to school staff and children, following these guidelines will help ensure that disinfectant use in schools does more good than harm.

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