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COVID-19 and the Use of Disinfectants

Part of the response to the COVID-19 pandemic has been the recommendation that "Frequent disinfection of surfaces and objects touched by multiple people is important." (https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html). An increased use of disinfectants may increase the number of adverse health effects that will occur from exposure to disinfectants. In the April 20, 2020 MMWR, the CDC reported on the number of calls about cleaners and disinfectants to United States poison control centers from January 1, 2020 to March 30, 2020. Compared to the same time period in 2019, the number of calls about cleaners increased 20.4% and the number of calls about disinfectants increased 16.4% (1).

There have been multiple publications about the association between cleaning products, disinfectants and asthma and respiratory symptoms. These publications have included: cross-sectional and longitudinal studies, case reports and exposure analyses (2–6); specific respiratory allergens that have been identified in cleaning products (7–12); and studies that have identified an increased risk of developing asthma with both the frequency of use and the method of application (e.g., spraying versus wiping) of cleaning agents (13).

We examined the calls to the Michigan Poison Center (MiPC) located at the Wayne State University School of Medicine, which covers the entire state of Michigan. Data from the Michigan Poison Center ToxSentry system was accessed for two time periods: 1/1/2019 to 4/30/2019 and 1/1/2020 to 4/30/2020. Using the ToxSentry Query Builder, all exposure-related calls to the MiPC where the exposure was a cleaner or disinfectant were selected.

Unlike the national data reported by the CDC, which were grouped as all calls regarding cleaners and disinfectants, we also looked at subcategories within the call data, including: calls involving symptoms, and calls where the caller saw a health care provider.

Table 1a. Calls to the Michigan Poison Control Center Regarding Exposure to Cleaners or Disinfectants, 1/1/2019 - 4/30/2019 and 1/1/2020 - 4/30/2022

	Total 2019 Calls #	%	Total 2020 Calls #	%
Total	1505		1805	
Age group (years)[1]				
0-5	851	(60.2)	852	(48.2)
6-15	79	(5.6)	84	(4.8)
16+	483	(34.2)	831	(47.0)
Exposure route[2]				
Ingestion	1090	(72.6)	1064	(59.7)
Inhalation	116	(7.7)	231	(13.0)
Dermal	169	(11.3)	340	(19.1)
Ocular	127	(8.5)	147	(8.2)
Exposure location[3]				
Workplace	55	(3.8)	69	(4.0)
Home	1411	(96.2)	1676	(96.0)

We found an overall 4.5% increase in calls about cleaners and 47.7% increase in calls about disinfectants (Tables 1b and 1c). From 2019 to 2020, the proportion of calls about cleaners among all calls received by the MiPC increased from 5.11% to 5.43% ($p=0.183$) and the proportion of calls about disinfectants among all calls increased from 3.46% to 5.03% ($p<0.01$). An important difference between our data and the national report from CDC was that we included bleach as a disinfectant rather than in the cleaner category since bleach is approved and recommended as a disinfectant for COVID-19. Bleach accounted for 62.1% of the increase in cleaner-related calls in the national CDC data.

[1] Age unknown for 92 calls in 2019 and 38 calls in 2020
[2] Exposure other/unknown for 3 calls in 2019 and 23 calls in 2020
[3] Exposure location other/unknown for 39 calls in 2019 and 60 calls in 2020

There was a 13.2% increase in calls about cleaners where the caller had at least one symptom but despite an increase in calls with symptoms there was a 32.7% decrease in calls about cleaners where the caller saw a health care provider (Table 1b). For disinfectants, there was a 57.3% increase in calls where the caller had symptoms but as with cleaners, there was a 13.1% decrease where the caller saw a health care provider (Table 1c).The decrease in visits to a health care provider presumably reflects the general decrease in non-COVID-19 health care visits during this time.

Most calls to the poison control center about cleaners and disinfectants related to exposure at home (~96%). Ingestion was the most common route of exposure in all age groups; children five and under (73.8%); children 6-15 years (64.6%); and those 16 years and older (45.8%) (Chi-square trend test, p<0.01). From 2019 to 2020, ingestion as the route of exposure decreased from 72.6 to 59.7% (p<0.01) while inhalation and dermal exposures increased, respectively, (7.7% to 13.3%, p<0.01) and (11.3% to 19.1%, p<0.01) and ocular exposures were unchanged (8.5% to 8.2%, p = 0.76) (Table 1a).

Table 1b. Calls to the Michigan Poison Control Center Regarding Exposure to Cleaners, 1/1/2019-4/30/2019 and 1/1/2020 -4/30/2020

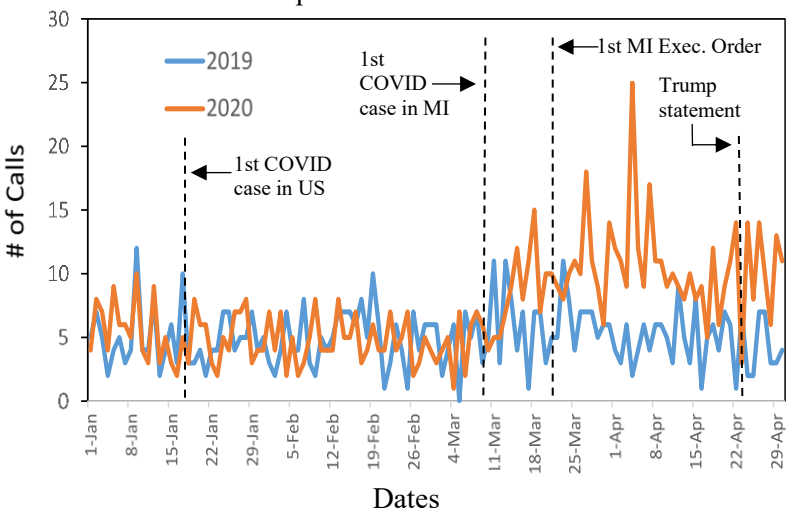
	Cleaners					
	2019			2020		
	All Calls # %	Calls s/SXs # %	Saw Providers # %	All Calls # %	Calls w/SXs # %	Saw Provider # %
Total	897	302	159	937	342	107
Age group (years)						
0-5	585 (68.3)	155 (53.4)	67 (43.2)	552 (59.9)	142 (42.3)	39 (36.4)
6-15	42 (4.9)	17 (5.9)	8 (5.2)	41 (4.5)	16 (4.8)	4 (3.7)
16+	230 (26.8)	118 (40.7)	80 (51.6)	328 (35.6)	178 (53.0)	64 (59.8)
Exposure route						
Ingestion	707 (79.1)	196 (65.3)	105 (66.9)	642 (69.3)	170 (50.0)	58 (54.7)
Inhalation	34 (3.8)	19 (6.3)	10 (6.4)	54 (5.8)	33 (9.7)	5 (4.7)
Dermal	93 (10.4)	41 (13.7)	24 (15.3)	160 (17.3)	73 (21.5)	19 (17.9)
Ocular	60 (6.7)	44 (14.7)	18 (11.5)	71 (7.7)	64 (18.8)	24 (22.6)
Exposure location						
Workplace	30 (3.4)	21 (7.1)	20 (13.0)	26 (2.9)	19 (5.8)	10 (10.1)
Home	850 (96.6)	274 (92.9)	134 (87.0)	878 (97.1)	308 (94.2)	89 (89.9)

Table 1c. Calls to the Michigan Poison Control Center Regarding Exposure to Disinfectants, 1/1/2019-4/30/2019 and 1/1/2020 -4/30/2020

	Disinfectants					
	2019			2020		
	All Calls # %	Calls w/SXs # %	Saw Provider # %	All Calls # %	Calls w/SXs # %	Saw Provider # %
Total	608	234	120	868	368	93
Age group (years)						
0-5	266 (47.8)	54 (24.9)	27 (22.9)	300 (35.5)	69 (19.2)	17 (18.3)
6-15	37 (6.7)	22 (10.1)	18 (15.3)	43 (5.1)	23 (6.4)	9 (9.7)
16+	253 (45.5)	141 (65.0)	73 (61.9)	503 (59.5)	268 (74.4)	67 (72.0)
Exposure route						
Ingestion	383 (63.0)	100 (42.7)	79 (65.8)	422 (49.4)	121 (33.0)	57 (61.3)
Inhalation	82 (13.5)	48 (20.5)	11 (9.2)	177 (20.7)	103 (28.1)	10 (10.8)
Dermal	76 (12.5)	30 (12.8)	13 (10.8)	180 (21.1)	81 (22.1)	13 (14.0)
Ocular	67 (11.0)	56 (23.9)	17 (14.2)	76 (8.9)	62 (16.9)	13 (14.0)
Exposure location						
Workplace	25 (4.3)	21 (9.3)	13 (11.6)	44 (5.2)	36 (10.0)	15 (17.4)
Home	561 (95.7)	206 (90.7)	99 (88.4)	797 (94.8)	323 (90.0)	71 (82.6)

Between 2019 and 2020, there was no statistical difference in calls each day for exposure to cleaners (Kendall rank correlation coefficient of 0.047 (P=0.456) (data not shown). Figure 1 shows the number of calls each day for disinfectants. For disinfectants, there was a statistically significant increase in calls (Kendall rank correlation coefficient of 0.306 (P<0.001)). The four dashed lines on the graph mark the following dates; 1/19/20 first case reported in the United States in the state of Washington; 3/10 first case reported in Michigan; 3/22 first executive order from the Governor of Michigan on social distancing; 4/23 statement from President Trump about ingesting/ injecting disinfectants. The average number of calls per day about exposure to disinfectants were statistically significantly greater after 3/11 (9-10.8 vs. 4.8-5.5 calls/day) but was not significantly increased for cleaners (6.6-7.6 vs. 8.0 vs.8.4).

Figure 1. Number of Calls per Day to the Michigan Poison Control Center from 1/1/20 to 4/30/20 for Exposure to Disinfectants



The calls to the poison control center indicate an increase in exposure and symptoms from the use of disinfectants. This increase in calls underscores the importance of proper use of disinfectants, and avoiding over-use of these chemicals to maximize their benefits and minimize their adverse effects. Improper mixing of bleach products with either an acid or an ammonia product can generate chlorine or chloramine fumes that can cause chemical pneumonitis and/or pulmonary edema. Not following the direction on dilution and over-concentrating or preparing the compounds for use in a poorly ventilated utility closet or bathroom increases exposure. Ingestion is a major route of exposure for both adults and children; containers need to be properly labeled so they are not mistakenly drank and not left or stored where young children can access them. Use of gloves and eye protection, and applying with a rag rather than spraying are all important ways to reduce potential exposure.

Prior to the COVID-19 pandemic, brochures and guidelines for the use of bleach and other disinfectants, cleaning in general, and cleaning in schools and childcare centers had been developed (See box: Resources for Cleaning). A cross-sectional survey of custodians found that custodians had more dermal, and upper and lower respiratory symptoms with increasing use of traditional cleaning products, some of which contained disinfectants, than with increasing use of environmentally preferable cleaning products, defined as cleaning products in the EcoLogo or Green Seal databases (14). The criteria used by EcoLogo and Green Seal to define green cleaning agents at the time of the cross-sectional survey of custodians prohibited asthma causing agents. However, one would want to ensure that the disinfectant is effective against the Coronavirus. The EPA List N at https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2 identifies products that meet the criteria for use against SARS-CoV-2. The EPA-approved list includes compounds that are not known to cause asthma or allergic rhinitis but since they are irritants, these compounds might exacerbate symptoms in an individual who already has asthma, COPD or rhinitis. Potential irritants on the approved list are citric acid, ethanol, glycolic acid, isopropanol, lactic acid, phenolic, hydrogen peroxide, and hypochlorous acid. The allergens on the EPA-approved list are bleach (sodium hypochlorite), and quaternary ammonium compounds.

Resources for Cleaning

Home and different types of Community facilities
CDC, https://www.cdc.gov/coronavirus/2019-ncov/community/reopen-guidance.html
EPA list of disinfectants
https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2
Schools
California Department of Public Health, Healthy Cleaning & Asthma-Safer Schools: A How-To Guide. https://tinyurl.com/CLASSguidelines.
Coalition for Healthier Schools. http://healthyschools.org/Cleaning-For-Healthy-Schools/
Workplaces
MSU, Cleaning and Sanitizing with Bleach at the Workplace: What You Need to Know! - Guidelines for Employees https://oem.msu.edu/images/misc/BleachBrochureAugust2017.pdf
MSU, Asthma and Cleaning Agents. What you Need to Know! https://oem.msu.edu/images/misc/Asthma_CleaningAgents2017.pdf

Dr. Rosenman is available, if you have any medical questions regarding patients and cleaner/disinfectant exposures. The best way to reach him during this time is via his email. rosenman@msu.edu. He can then arrange a time to talk by phone.

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