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Mold clean-up practices vary by sociodemographic and allergy factors

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Abstract

We examined mold clean-up practices in a general population (not selected on history of natural disaster).

We used a population-based survey (n= 3,624) to assess associations between sociodemographic/ housing/ respiratory health variables and mold clean-up, PPE use, and cleaning agent use.

Bleach was the most commonly used cleaning agent with approximately 90% of residents reporting using bleach alone or with other agents. More respondents used gloves (76%) than any other PPE. The use of PPE varied; 42% of bleach users wore a breathing mask/respirator compared with only 19% of soap and water users. Hispanic populations frequently reported mold clean-up. Bleach use was less likely in the West and among Asians. Although “Green” products were rarely used, Asians were more likely to use them.

Bleach was the most commonly used cleaning agent for mold, and PPE use was common when using bleach, supporting the need for current CDC safe use recommendations.

Keywords

mold; fungi; remediation; bleach; PPE; allergy; asthma

Introduction

Mold remediation is common after hurricanes and floods and includes use of varied cleaning agents and personal protective equipment (PPE). Respiratory protection used in this remediation frequently varies in frequency and type, as it did after Hurricane Katrina (Cummings & Kreiss, 2008; Riggs et al., 2008). In 2015, the Centers for Disease Control and Prevention (CDC) and other federal agencies published post-disaster mold cleanup

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guidance (EPA, CDC, FEMA, HUD, NIH, 2015). This guidance recommends eye, skin, mouth, and respiratory protection and includes safe cleaning agent use advice. We examined mold clean-up practices in a general population not selected on history of natural disaster.

Methods

Styles surveys are conducted multiple times annually by Porter Novelli Public Services via an online panel representative of the non-institutionalized U.S. adult population. The fall 2019 survey was sent to 4,677 panelists 10/8/2019 to 10/22/2019. 3,624 adults completed the survey (response rate of 77.5%). In addition to sociodemographic and health questions, we asked three mold remediation questions.

1. How many times have you cleaned up mold caused by flooding or a roof, window, or plumbing leak?
2. What have you used to clean up mold?
3. When cleaning up mold what have you worn to protect yourself?

Statistical analysis

Mold clean-up was used as a dichotomous variable because few (33%) respondents reported clean-up more than once. Cleaning agent use was categorized as bleach only, soap and water only, vinegar only, and “Green” only. Bleach use with report of any other product was combined into a bleach and other category. PPE use was dichotomized for any use of PPE, gloves, facemask/respirator, and goggles. Associations between sociodemographic/ housing variables and mold clean-up, PPE use, and cleaning agent use were tested with bivariate and multiple logistic regression models (to adjust for confounding).

Results

Mold clean-up

For mold clean-up (at least once in the past), 2,600 respondents reported mold clean-up and 1,024 did not report mold clean-up. Several sociodemographic and housing variables were significantly associated in bivariate models (Table 1). In an adjusted model (with all significant variables listed in Table 1), Hispanic ethnicity was a significant predictor for mold clean-up (OR = 1.75, 95%CI [1.04–2.95]).

Cleaning agent(s) used

About half of respondents used only one agent. This percentage dropped as the number of products increased (28% used two types, 15% used three, 6% used four, and 2% used five). Bleach was the most commonly used cleaning agent with approximately 90% of residents reporting using bleach alone or with other agents. Full-strength bleach was used by 52% of respondents. When exclusive product use was examined, bleach only was most common (46%) followed by soap and water only (2%), vinegar only (2%) and “Green” cleaners only (2%).

Regression analyses of exclusive use of agents are shown in Table 1. Several sociodemographic, health, and housing variables were significantly associated in bivariate models.

In the adjusted model for bleach only (with all significant variables listed in Table 1), the only variable remaining significant was Western region (OR=0.5, 95%CI [0.3–0.8]. For bleach and others, Hispanic ethnicity (OR = 3.9, 95%CI [1.5–9.9] and Asian race (OR = 0.3, 95%CI [0.1–0.8] remained significant. For soap only, age category (OR = 0.8, 95%CI [0.7–1.0]) and allergy (OR = 0.5, 95%CI [0.3–0.9]) remained significant. For vinegar only, Apartment residence (OR=0.2, 95%CI [0.0–0.8]; Black race (OR=0.1, 95%CI [0.0–0.4]; and Other race (OR=11.0, 95%CI [1.3–95.3] remained significant. For “Green” only, Hispanic ethnicity (OR=0.2, 95%CI [0.1–0.8] and Asian race (OR=6.7, 95%CI [1.2–36.5] remained significant.

PPE used

Overall, more respondents used gloves (76%) than any other PPE (Figure 1). When cleaning agent use was focused on specific types, the use of PPE varied; 42% of bleach users wore a breathing mask/respirator compared with only 19% of soap and water users. In an adjusted model (with all significant variables listed in Table 1), only Black race remained statistically significant (OR = 3.8, 95%CI [1.7–8.3]).

Discussion

Hispanic populations and those with allergy frequently reported mold clean-up. Individuals with allergy could be following guidance to remove a common allergy trigger. However, Hispanic ethnicity could reflect inequities in housing that give rise to water damage and mold growth (Jacobs, 2011).

Bleach was the most commonly used cleaning agent; other investigators have also observed its common use (32% reported monthly, weekly, or daily use) (Parks et al., 2020). Soap and water, vinegar, and “Green” cleaners were rarely used. Adjusted models showed those with allergy less likely to use soap and water to remove mold. Bleach may be seen as a stronger agent to remove mold. Hispanics were likely to use bleach. Bleach use was less likely in the West and among Asians. Although “Green” products were rarely used, Asians were more likely to use them.

Facemask/respirator use was higher in this general population than among the immunocompromised population following Hurricane Harvey (Chow et al., 2019). If PPE use were driven mainly by a need to protect the user from mold exposure, we would expect the same PPE use across all types of cleaning agents, but PPE use varied with agent. Facemasks/respirators were more common for users of bleach, vinegar, and “Green” products, yet most facemasks and disposable N95 respirators do not protect against vapors or gases. Given that only 20% of bleach users reported not using any PPE (compared with 31–45% of the users of other cleaners), bleach users may know there is some inherent danger to using bleach, hence they take precautions. The 20% of bleach users not using PPE may also reflect minor or routine cleaning as opposed to extensive remediation cleaning.

Given the lower percentages reported for PPE use associated with use of non-bleach cleaners, the dangers of bleach appear frequently recognized and the dangers of other cleaners insufficiently recognized.

Conclusion

Our findings demonstrate that bleach is the most common cleaning agent and that PPE use is common when using bleach, supporting the need for current CDC safe use recommendations (CDC, 2019). Bleach effectively kills mold and denatures proteins of many allergens (Chen & Eggleston, 2001; Reynolds, Boone, Bright, & Gerba, 2012). In practice, allergists could also consider cultural differences in how patients clean mold and recommend guidance to use cleaners and PPE appropriately.

List of Abbreviations

CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
OR	Odds Ratio

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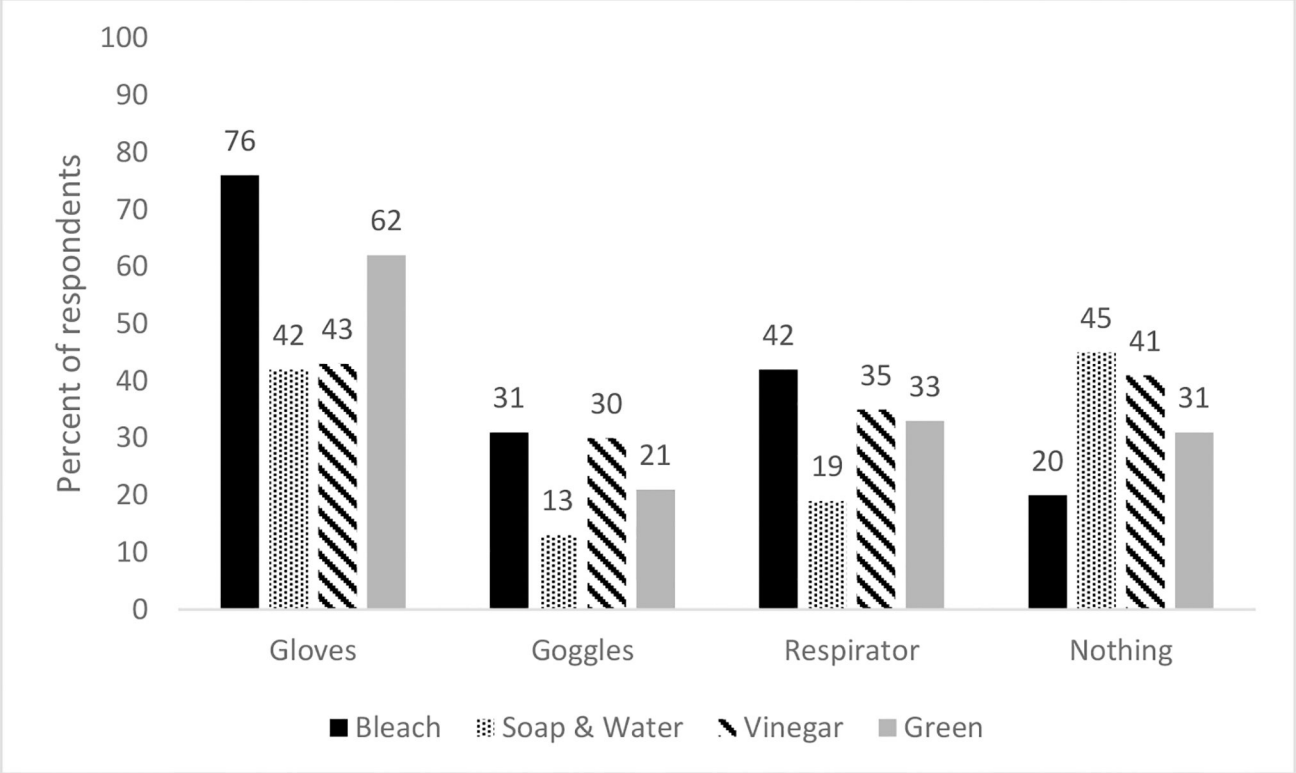

Figure 1.
Personal protective equipment (PPE) use by cleaning agent

Table 1.

Associations between covariates, mold clean-up, and mold cleaning agents[1]: Bivariate logistic regression models

	Odds Ratio (95% CI)				
		Cleaning Agent			
Predictor variables	**Mold clean-up**	**Bleach**	**Soap and Water**	**Vinegar**	**Green product**
Age category (1 = 18–29; 2 = 30–44; 3 = 45–59; and 4 = ≥ 60)	1.1*** (1.1–1.2)	1.2*** (1.1–1.2)	0.8* (0.7–1.0)	0.8* (0.6–0.9)	1.1 (0.9–1.3)
Renter	0.8* (0.6–0.9)	0.7*** (0.6–0.8)	1.1 (0.5–2.1)	1.9 (1.0–3.6)	0.7 (0.3–1.6)
Gender	1.0 (0.8–1.2)	1.0 (0.8–1.2)	1.0 (0.5–1.8)	0.7* (0.5–1.0)	1.1 (0.8–1.4)
Education level	1.2** (1.1–1.3)	1.0 (1.0–1.1)	1.1 (0.8–1.6)	1.2 (0.6–2.3)	1.2 (0.7–2.1)
Region (1 = Northeast; 2= Midwest, 3=South, 4 = West)	1.0 (0.9–1.1)	1.0 (0.9–1.0)	1.1 (0.8–1.5)	1.3 (0.9–1.8)	0.9 (0.7–1.1)
South	1.2 (1.0–1.4)	1.2* (1.0–1.5)	0.6 (0.3–1.1)	0.6 (0.3–1.2)	1.2 (0.6–2.1)
West	0.9 (0.7–1.1)	0.7** (0.6–0.9)	1.7 (0.9–3.3)	2.3* (1.1–4.7)	0.7 (0.3–1.4)
Single-family house	1.4** (1.2–1.7)	1.6*** (1.3–1.9)	0.9 (0.5–1.8)	0.6 (0.3–1.1)	0.8 (0.4–1.6)
Apartment	0.7*** (0.5–0.8)	0.6*** (0.5–0.7)	1.1 (0.5–2.2)	2.1* (1.1–4.0)	1.4 (0.7–2.8)
Mobile home	1.4 (0.8–2.2)	1.1 (0.7–1.7)	1.1 (0.2–8.2)	0.4 (0.1–2.9)	0.6 (0.1–2.5)
Hispanic ethnicity	1.8* (1.1–3.0)	1.6 (1.0–2.5)	0.4 (0.1–1.3)	0.2** (0.0–0.5)	0.4 (0.1–1.2)
Metropolitan Statistical Area category (1= non-Metro; 2=Metro)	1.0 (0.7–1.2)	1.0 (0.8–1.3)	2.4 (0.9–6.3)	1.5 (0.5–4.3)	1.0 (0.4–2.2)
Race (American Indian/Alaska Native)	0.9 (0.3–2.6)	0.7 (0.2–1.9)	2.4 (0.3–18.5)	0.3* (0.1–0.7)	2.9 (0.4–23.8)
Race (Asian)	1.1 (0.5–2.5)	0.7 (0.4–1.4)	3.3 (0.9–13.0)	1.4 (0.2–9.7)	3.7 (0.8–18.1)
Race (Black)	1.5 (0.7–3.1)	1.3 (0.7–2.4)	0.8 (0.2–3.7)	0.2*** (0.1–0.4)	1.0 (0.1–6.7)
Race (Hawaiian/Pacific Islander)	2.0 (0.6–6.3)	1.0 (0.2–4.9)	2.1 (0.3–14.6)	0.6 (0.2–1.4)	0.6 (0.2–1.4)
Race (White)	0.7 (0.4–1.2)	1.2 (0.8–1.8)	0.7 (0.2–2.2)	0.3* (0.1–0.9)	0.4 (0.1–1.2)
Race (Other)	0.7 (0.3–1.6)	0.6 (0.3–1.2)	1.3 (0.2–8.7)	17.5*** (4.7–65.9)	1.1 (0.2–6.9)
Race (Don’t know)	2.0 (0.6–6.4)	1.0 (0.2–4.9)	0.6 (0.2–1.5)	0.6 (0.2–1.5)	0.6 (0.2–1.5)
Asthma	1.3 (0.9–1.8)	0.8 (0.6–1.0)	0.6 (0.3–1.1)	0.9 (0.4–2.4)	0.5 (0.1–1.7)

	Odds Ratio (95% CI)				
		Cleaning Agent			
Predictor variables	**Mold clean-up**	**Bleach**	**Soap and Water**	**Vinegar**	**Green product**
COPD	1.6* (1.0–2.6)	1.1 (0.7–1.6)	2.1 (0.6–7.2)	0.9 (0.4–1.7)	0.5 (0.1–5.1)
Allergy	1.3** (1.1–1.6)	1.0 (0.8–1.2)	0.5* (0.2–1.0)	1.0 (0.5–2.0)	0.5* (0.2–1.0)
Physical Activity limitation	1.0** (1.0–1.1)	1.0 (1.0–1.0)	1.0 (0.9–1.0)	0.9* (0.8–1.0)	1.0 (0.9–1.1)

[1]Cleaning agents were reported as exclusively using a single product (e.g., bleach only, soap and water only, vinegar only, or green product only).

*$p < 0.05$;

**$p < 0.01$;

***$p < 0.0001$;