Perceptions About Messaging and Constructs Relevant to Personal Protective Equipment (PPE) Use During Mold Cleanup Among Persons Affected by Hurricane Ida—Louisiana, USA, 2021

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Objective: Research suggests that PPE is underused during mold cleanup after hurricanes, despite mold's association with adverse health outcomes. This study aims to improve understanding of decision-making around PPE use to shape messaging after natural disasters. **Methods:** A convenience sample of adult residents and workers in Louisiana parishes affected by Hurricane Ida responded to closed- and open-ended questions about mold cleanup perceptions. Content analysis drew on the Health Belief Model (HBM). **Results:** Qualitative findings indicate that perceived barriers to PPE use included discomfort and inconvenience. Many respondents understood important concepts related to respirator user seal checks and/or fit tests; some responses indicated misunderstandings. Many sample residents (n = 150/238, 63%) and workers (n = 40/68, 59%) had not encountered state-driven health messages about mold cleanup. **Conclusions:** Results could inform message development for promoting recommended PPE use in hurricane-affected areas.

Keywords: mold, personal protective equipment, natural disasters, health belief model, health communication, qualitative research

Natural disasters like hurricanes can cause extensive flooding and damage to homes and businesses,[1] creating environments that support mold growth.[2] Mold exposure is associated with adverse respiratory outcomes such as wheeze, cough, dyspnea, asthma development and exacerbation,[3,4] and other health issues.[2,5] Those who live or work in moldy buildings might be at an increased risk of exposure.[2] Because of the potential health effects of mold exposure, agencies such as the Centers for Disease Control and Prevention (CDC) recommend wearing personal protective equipment (PPE), including gloves, eye protection, and tight-fitting National Institute for Occupational Safety and Health (NIOSH) Approved® particulate air-purifying respirators, while cleaning or remediating mold.[6,7]

LEARNING OUTCOMES

- Readers will understand how constructs defined by the Health Belief Model might be relevant to individual decision-making around PPE use during mold cleanup.
- Readers will be able to discuss differences in perceptions commonly cited by people who reported using versus not using recommended PPE during mold cleanup.
- Readers will be able to identify common areas of misunderstanding around respirator fit.

However, prior research suggests that many residents and remediation workers do not use recommended PPE for mold cleanup after hurricanes,[8–10] even among those who demonstrated knowledge of mold-specific PPE recommendations[8] and who endorsed the importance of following these recommendations.[10] Thus, it is important to understand factors that might influence PPE-related perceptions and usage during mold cleanup to inform focused messaging efforts.[11]

A better understanding of decision-making involved in using (or not using) PPE can help shape health-protective messaging after natural disasters. As part of emergency response efforts, we conducted a survey among residents and workers in Hurricane Ida–affected areas of southern Louisiana to assess knowledge, attitudes, and practices around mold cleanup and PPE use. The questions related to mold messaging, including structured, open-ended questions regarding mold-related risk perceptions and PPE use. This study examined responses to explore perceived risks of mold, decision-making related to PPE use, and knowledge around mask or respirator fit.

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Funding Sources: None declared.

Conflict of Interest: The authors report there are no competing interests to declare.

Author contributions: Conceptualization: A.O., A.M.F., J.H.P., G.L.C.; Methodology: A.O., A.M.F., E.H., S.M.M., J.H.P., G.L.C.; Validation: A.O., A.M.F., E.H.; Formal analysis: A.O., A.M.F.; Investigation: A.O., A.M.F., K.J.M., A.N.T., A. R., A.B., S.S., C.M.J.; Writing – original draft: A.O., A.M.F.; Writing – review & editing: A.O., A.M.F., E.H., S.M.M., S.A.D., K.J.M., A.N.T., J.H.P., J.M.C., A.R., A.B., S.S., C.M.J., G.L.C.; Supervision: G.L.C.; Project administration: A.O., S.S., G.L.C.

Data availability: Please contact the Louisiana Department of Health.

AI statement: No AI was utilized at any stage during the study's development and design, data collection, analysis, or manuscript preparation.

Ethical considerations: This activity was reviewed by the CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy. See, for example, 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health or Centers for Disease Control and Prevention.

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Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).

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DOI: 10.1097/JOM.0000000000003529

Similar to a previous study,[10] we used the Health Belief Model (HBM) to analyze perceptions and behaviors around PPE usage among hurricane-affected residents and workers. Although the survey was designed for an emergency response rather than to evaluate a particular theory or model, the HBM is relevant and useful for examining behavior descriptively.

The HBM focuses on decision-making at the individual level and describes perceived susceptibility and severity (ie, perceived threat), perceived barriers and benefits, perceived self-efficacy, and cues to action. *Perceived threat* is an individual's assessment of the risk of an outcome (eg, illness) and the severity of its potential consequences. For those in hurricane-affected areas, perceived threat might include perceived susceptibility to illnesses from mold exposure and perceived severity of such illnesses.[12] *Perceived barriers* refer to an individual's assessment of the obstacles or costs associated with the desired health behavior (ie, recommended PPE use). Examples include discomfort, annoyance, inconvenience, and cost. *Perceived benefits* associated with PPE use during mold cleanup may be protecting individual health. *Perceived self-efficacy* refers to an individual's confidence that they are capable of performing a particular behavior in a particular setting. Relevant behaviors include identifying, selecting, and appropriately using recommended PPE during mold cleanup. Low perceived threat or self-efficacy, or the existence of perceived barriers, might be associated with reduced recommended PPE use.[12,13] Finally, *cues to action* include messaging that reminds individuals to use recommended PPE during mold cleanup.[12]

The study aimed to (1) qualitatively analyze responses to open-ended questions regarding mold-related risk perceptions and PPE to identify common themes guided by HBM among residents and workers in southeastern Louisiana after Hurricane Ida, and (2) describe respondents' preferences about messaging regarding PPE use during mold cleanup. Findings can inform approaches to reach hurricane-affected residents and workers with mold-related messages.

METHODS

Data

The study data comprise survey results from a convenience sample of English- or Spanish-speaking adult residents and workers who lived, worked, or volunteered in Louisiana parishes with flooding and building damage from Hurricane Ida, collected at the request of the Louisiana Department of Health. Residents and workers 18 years or older were recruited in-person at recruitment sites (including 13 home improvement stores, three not-for-profit organization and mold remediation training organization work sites, two farmers markets, one FEMA Disaster Recovery Center, and one rural health clinic) between December 4 and 14, 2021, during recovery and renovation efforts (Hurricane Ida made landfall on August 29, 2021). Additional detail on data collection is described elsewhere.[14] This activity was reviewed by the CDC, was deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§]

Qualitative Questions and Content Analysis

Survey administrators asked three open-ended questions: (1) among those responding "yes" or "no" to the stem question, "Do you think you are personally at risk of getting sick from mold?" respondents were asked the open-ended question: "Why do you think you are/aren't at risk of getting sick from mold?" (2) If respondents reported having personally cleaned up mold and after specifying their PPE use, they were asked, "Why do you use/not use this protective equipment?" and (3) "How do you know that a mask[†] fits?" To ensure that participants would consider the full spectrum of respirators, despite the simplified terminology of "mask," respondents were shown a display of face-worn products that included (1) NIOSH Approved® respirators and respirators meeting international standards, (2) cloth masks and disposable face masks, and (3) face coverings such as bandanas. The face-worn products shown included those considered to be protective from a mold hazard when used properly (ie, respirators) and those *not* considered to be protective from a mold hazard, even when used properly (ie, cloth masks, disposable face masks, and face coverings). Participants self-reported other types of PPE without visual aids. Survey administrators took detailed notes to record the verbal responses to each open-ended question.

Given the straightforward nature of the open-ended questions and field notes, which included brief responses, we selected a qualitative descriptive content analysis approach guided by the HBM. Qualitative descriptive analyses focus on "low-inference description."[15,16] Thus, the analysis aimed to develop codes that stayed close to the ideas expressed by respondents rather than more interpretive connections.

Two researchers separately completed initial coding of the responses. Initial codes[17] identify recurrent ideas in the data. The researchers then reviewed their initial codes together to inform one comprehensive list of final codes and to group codes into categories. This process utilized consensus-building to identify, agree upon, and finalize categories with deductive assessment regarding how codes related to HBM constructs.[12,17] For example, separately, the two researchers identified codes related to using PPE to protect oneself or others. After meeting to discuss, the researchers agreed that these codes related to the "perceived benefits" of PPE use during mold cleanup.

After all categories were decided, the researchers referred to the frequency of the codes occurring within each. Because these data were collected as part of an emergency response, saturation of the open-ended responses was not continuously assessed. Therefore, codes assigned to only a single response and responses with unclear meanings were dropped. Although the frequency of some codes might not have reached *code* saturation (ie, some codes had few instances reported), the researchers were most concerned that the pattern of codes within each category met the criteria for *meaning* saturation.[18]

Despite relatively similar patterns of responses by workers and residents, frequencies of categories and codes are reported separately for workers and residents. "Workers" self-reported that they were involved in mold clean-up activities as part of their job, on a volunteer basis or for wages. "Residents" resided in the survey catchment area but were not involved in mold clean-up activities as part of their job. With variation depending on their employer or volunteer organization, workers might be more likely than residents to fall under respiratory protection programs (RPPs[19,20]), to have access to fit testing, to be provided NIOSH Approved respirators, and to receive information about mold exposure and PPE from employers.[20]

Because sample respondents who are current or former smokers were more likely to report perceived risk from mold compared with never smokers, supplemental materials also display responses to "Why do you think you are/aren't at risk of getting sick from mold?" stratified by ever smoking (Table S1, http://links.lww.com/JOM/C83), as well as responses to "How do you know a mask fits?" stratified by whether the respondent endorsed only using recommended respirators while cleaning mold (Table S2, http://links.lww.com/JOM/C83).

Quantitative Items and Analysis

The survey asked, "Have you ever heard or seen any public messages from the State, like the health department, or government

[§]See, for example, 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

[†]The term "respirator" most accurately refers to NIOSH Approved respirators and those meeting international standards. However, at the time that the survey was administered, communications with the public commonly focused on prevention of COVID-19 and used the term "mask" to refer to face-worn products that provided varying degrees of respiratory protection or source control (such as surgical masks, which capture the wearer's respiratory secretions that may occur during breathing, talking, sneezing, etc).

about cleaning up mold? (for example, public service announcements on radio, TV, billboards, flyers, or social media)." Those who answered affirmatively were asked, "Was this information helpful to your cleanup efforts?" Respondents selected their main source of information about mold and their perception of the best channels to disseminate mold-related messages to the public. They were also asked if they had previously seen any of three existing federal communications materials relevant to mold cleanup.[6,21,22] We describe frequencies and proportions of responses, stratified by resident versus worker respondents.

RESULTS

Detailed descriptive statistics regarding the sociodemographic makeup of the sample (238 residents, 68 workers) are described elsewhere.[14] Overall, the sample was majority male, non-Hispanic or non-Latino, and English speaking. Prior to Hurricane Ida, the same parishes were impacted by hurricanes and flooding such as those caused by Hurricanes Rita and Katrina in 2005.[9] Finally, Supplemental Figures 1 and 2 (http://links.lww.com/JOM/C83) detail how stem questions, nonresponse, and dropped responses were taken into account to tabulate denominators (*N*'s) for Tables 1 and 2 (no stem questions preceded the analysis described in Table 3). Denominators are also given throughout the results where frequencies are referenced.

Open-Ended Results

Perceived Risk of Getting Sick From Mold

Respondents were asked to reflect on their perceived "risk of getting sick from mold," which is relevant to the perceived threat including both perceived susceptibility to and perceived severity of getting sick from mold.

Low Perceived Risk

Among respondents who did not feel at risk of getting sick from mold, 77 (of 131) communicated that was because of a *lack of exposure* (Table 1, code titles are italicized at first use), for example, stating that they "don't have any mold in [their] home." Some respondents stated that they *avoid mold exposure*, for example, through "try[ing] not to expose myself," or that they would *be at risk if exposed* (eg, "could be if exposed").

Several residents and workers cited taking recommended action to explain why they did not feel at risk of getting sick from mold. For example, 24 (of 108) residents described that mold was cleaned or remediated, such as one who described that "mold has been remediated" or another who described that "I've taken measures to eliminate mold." Several workers (12/23) specifically described *PPE usage/taking precautions*, for example, citing "proper PPE."

Several respondents (15/131) discussed a lack of perceived susceptibility or *sense of immunity* from getting sick from mold. Responses were grouped with this code when the respondent described their low susceptibility as an inherent trait. Examples include respondents citing their "good immune system," "good luck," or "being healthy."

Six respondents described that they "know how to deal with mold," showing a sense of self-efficacy around behaviors that would protect them from mold exposure. Other examples of this type of response included "I know how to handle it" or "because I know what I'm doing."

High Perceived Risk

Many respondents who felt at risk of getting sick cited reasons related to being *exposed to mold* (88/144), for example, from "living in [a] house with mold," "work[ing] around it," or being "constantly around it." Many also described that they would be at *risk if exposed*; one respondent explained that "if there's mold you're going to get sick."

Several respondents (56/144) described an increased perceived susceptibility to or severity of getting sick from mold. For example, 22 (of 144) respondents described that they have an *underlying health issue or risk factor* that increased their perceived susceptibility. For example, one resident explained that they are "highly allergic," whereas another reported that they "have [a] chronic medical issue." Some respondents (15/144) described that they had *experienced health effects from mold in the past*. For example, one resident said they "get sinus infections when I smell it." Some residents (13/104) described their perception that *mold is dangerous*, with relevance for the perceived severity of getting sick from mold. Statements marked with this code include, "mold can make you sick," or "it's bad." Two residents highlighted *negative messages about mold* they'd heard, such as one who felt at risk "because she read/learned about [mold] and isn't comfortable."

Just 3 (of 144) respondents described *perceived barriers to PPE* usage as a reason they felt at risk of sickness from mold. For example, one worker said they felt at risk due to their "employer not giving proper PPE."

PPE Use or Nonuse

Why Respondents Used Protective Equipment

Of the 114 respondents who reported personally cleaning mold, the most frequently mentioned reason for wearing PPE was to prevent exposure (Table 2). Because respondents could have conceptualized preventing exposure as a perceived benefit, or as a way to avoid a perceived threat, we included this as its own category rather than collapsing it under one HBM construct. Among the 51 (of 133) respondents who cited exposure prevention, many wanted to *avoid inhaling mold*; *avoid mold exposure on skin, eyes, or clothing*; and *avoid exposure to cleaning products*. For those wanting to avoid inhaling mold, example responses included "so it won't get in lungs." Related to avoiding mold exposure on skin, eyes, or clothing, cited reasons included "don't want to get mold on hands." For those interested in avoiding exposure to cleaning products, some respondents described that "cleaning solution is corrosive."

A perceived benefit mentioned by 38 (of 133) respondents was wearing PPE for *personal protection or safety,* describing sentiments like "protect myself" and "stay safe." Another perceived benefit to wearing PPE that seven respondents mentioned was to *protect family/others*. This included statements like "to protect my kids" and "make sure I don't spread it." *Staying healthy* (eg, "take care of health") was another perceived benefit of PPE use (3/133 respondents).

Along a similar vein, respondents described perceived threat, with 24 (of 133) citing *avoiding sickness* as a reason for wearing PPE (eg, "don't want to get sick from mold"). Three respondents reported *disgust/fear of mold*, for example, describing that they use PPE "[because] it was nasty."

Why Respondents Did Not Use Protective Equipment

The most common reason respondents gave for not wearing PPE was related to perceived barriers; 12 (of 43) mentioned that PPE was *uncomfortable/annoying to wear* (eg, "don't want to wear it because it was hot, no A/C"), and 5 (of 43) cited *time constraints [to don and doff]* (eg, "need to work fast").

Low perceived threat was also a cited reason for not wearing PPE. This category includes responses that discounted the risk of exposure, including *mold type was not dangerous/small amount of mold* (11/43 respondents) or *low perceived susceptibility to illness* (4/43 respondents). Some described that "mold didn't cover a large enough area to be too concerned about protective equipment," and "If it's just in your house and there's not so much mold, you just spray it with bleach and move on."

Cues to Action Influencing PPE Use and Nonuse

Some residents and workers mentioned cues to action that reminded them to wear PPE, including *training or experience* (9/133 respondents) or *advice* (4/133 respondents) they received. For example, one resident stated that they wore PPE "because of my training at the plant." For those who had received advice, this included "reading online" and using PPE "because everyone said to wear it."

TABLE 1. Categories and Codes Identified Among Responses to the Open-Ended Question "Why do you think you are/aren't at risk of getting sick from mold?" Separated by Response (Yes/No) to the Stem Question, "Do you think you are personally at risk of getting sick from mold?" and by Resident/Worker Status, Southeast Louisiana—2021

		Resident Responses, No. (%)*		Worker Responses, No. (%)*		All Responses, No. (%)*	
Category	**Code**	**Category**	**Code**	**Category**	**Code**	**Category**	**Code**
Among those who did not feel at risk		$n = 108^{\dagger}$		$n = 23^{\dagger}$		$n = 131^{\dagger}$	
Lack of exposure	No mold exposure	70 (65)	59 (52)	7 (30)	6 (26)	77 (59)	65 (50)
	Avoid mold exposure	6 (5)	1 (4)	7 (5)			
	Risk if exposed	4 (4)	—	4 (3)			
	Don't know if exposed	3 (3)	—	3 (2)			
Took recommended action	Mold was cleaned/remediated	26 (24)	24 (21)	12 (52)	—	38 (29)	24 (18)
	PPE usage or took precautions	3 (3)	12 (52)	15 (11)			
Lack of perceived susceptibility	Sense of immunity	13 (12)	13 (12)	2 (9)	2 (9)	15 (11)	15 (11)
Self-efficacy	I know how to deal with mold	5 (5)	5 (4)	1 (4)	1 (4)	6 (5)	6 (5)
Among those who did feel at risk		$n = 104^{\ddagger}$		$n = 40^{\ddagger}$		$n = 144^{\ddagger}$	
Mold exposure	Exposure to mold	62 (60)	27 (26)	27 (68)	17 (40)	88 (61)	47 (33)
	Risk if exposed	29 (28)	9 (21)	38 (26)			
	Could be exposed without perceiving mold	7 (7)	4 (10)	11 (8)			
	Environmental factors	5 (5)	2 (5)	7 (5)			
Perceived susceptibility and severity	Underlying health issue/risk	45 (43)	19 (18)	11 (28)	3 (7)	56 (39)	22 (15)
	Experienced or witnessed health effects from mold previously	12 (12)	3 (7)	15 (10)			
	Mold is dangerous	13 (13)	6 (14)	19 (13)			
	Received negative messages about mold	2 (2)	—	2 (1)			
Perceived barriers to PPE usage	Lack of PPE usage/lack of access to PPE	1 (1)	1 (1)	2 (5)	2 (5)	3 (2)	3 (2)

*n Values are used as denominators for the percentages below. Percentages can sum to >100 because responses could receive more than one code and/or category.
†n Values refer to those who endorsed feeling at risk of getting sick from mold among residents, workers, and total respondents, respectively.
‡n Values refer to those who endorsed not feeling at risk of getting sick from mold among residents, workers, and total respondents, respectively.

TABLE 2. Categories and Codes Identified Among Responses to the Open-Ended Question "Why do you use/not use this protective equipment?" Separated by Whether the Respondent Was Giving Answers Related to Using or Not Using Protective Equipment and by Resident/Worker Status, Southeast Louisiana—2021

		Resident Responses, No. (%)*		Worker Responses, No. (%)*		All Responses, No. (%)*	
Category	**Code**	**Category**	**Code**	**Category**	**Code**	**Category**	**Code**
Reasons respondent uses protective equipment		$n = 81^{\dagger}$		$n = 52^{\dagger}$		$n = 133^{\dagger}$	
Prevent exposure	Avoid inhaling mold	37 (46)	14 (17)	14 (27)	8 (15)	51 (38)	22 (17)
	Avoid mold exposure on skin, eyes, or clothing		12 (15)	10 (19)	22 (17)		
	Avoid exposure to cleaning products		12 (15)	—	12 (9)		
	Avoid mold exposure—route unspecified		5 (6)	—	5 (4)		
Perceived benefits	Personal protection or safety	23 (28)	21 (26)	24 (46)	17 (33)	47 (35)	38 (29)
	Protect family/others		3 (4)	4 (8)	7 (5)		
	Stay healthy		—	3 (6)	3 (2)		
Perceived threat	Avoid sickness	14 (17)	13 (16)	13 (25)	11 (21)	27 (51)	24 (18)
	Disgust/fear of mold		1 (1)	2 (4)	3 (2)		
Cue to action	Training or experience	10 (12)	6 (7)	3 (6)	3 (6)	13 (25)	9 (7)
	Advice		4 (5)	—	4 (3)		
Reasons respondent does not use protective equipment		$n = 35^{\ddagger}$		$n = 8^{\ddagger}$		$n = 43^{\dagger}$	
Perceived barriers to PPE use	Uncomfortable/annoying to wear	10 (29)	6 (17)	7 (88)	6 (75)	17 (40)	12 (28)
	Time constraints [to don and doff]		4 (11)	1 (13)	5 (12)		
Low perceived threat	Mold type not dangerous/small amount or no mold	12 (34)	9 (26)	2 (25)	2 (25)	14 (33)	11 (26)
	Low perceived susceptibility to illness		3 (9)	1 (13)	4 (9)		
Lack of cue to action	Didn't think of it/forgets	15 (43)	6 (17)	—	—	15 (35)	6 (14)
	Access		5 (14)	—	5 (12)		
	Lack of knowledge		6 (17)	—	6 (14)		

*n Values are used as denominators for the percentages below. Percentages can sum to >100 because responses could receive more than one code and/or category.
†n Values refer to those who gave reasons for using protective equipment among residents, workers, and total respondents, respectively.
‡n Values refer to those who gave reasons for not using protective equipment among residents, workers, and total respondents, respectively.

TABLE 3. Categories and Codes Identified Among Responses to the Open-Ended Question "How do you know a mask* fits?" by Resident/Worker Status, Southeast Louisiana—2021

Category	Code	Resident Responses (n = 233), No. (%)†	Worker Responses (n = 68), No. (%)†	Total Responses (n = 301), No. (%)†
Green light: responses indicate understanding of one or more important concepts related to respirator fit	Seals/no gaps/no leaks	57 (24)	11 (16)	68 (23)
	Snug/tight	46 (20)	20 (29)	66 (22)
	Covers nose and mouth	40 (17)	9 (13)	49 (16)
	Breathe in or out to check for leaks	17 (7)	7 (10)	24 (8)
	Fit test	14 (6)	10 (15)	24 (8)
	Suction/negative pressure	9 (4)	9 (13)	18 (6)
	Cannot sense external odors	9 (4)	—	9 (3)
	Glasses don't fog	6 (3)	—	6 (2)
	Job training/experience	2 (1)	—	2 (1)
	Clean shaven	3 (1)	—	3 (1)
Yellow light: additional clarification might be necessary to ensure understanding of important concepts related to respirator fit	Squeeze nose piece	17 (7)	5 (7)	22 (7)
	Comfortable/can breathe	12 (5)	2 (3)	14 (5)
	Fit over facial hair	2 (1)	—	2 (1)
Red light: response might indicate lack of knowledge or misunderstanding of concepts important to respirator fit	General experience/just put it on	30 (13)	7 (10)	37 (12)
	Don't know	27 (12)	5 (7)	32 (11)
	Discomfort/difficulty breathing	5 (2)	2 (3)	7 (2)

*To ensure that participants would consider the full spectrum of respirators when responding to the question about "mask fit," despite the simplified terminology of "mask," respondents were shown a visual display of face-worn products that included (1) NIOSH Approved respirators and respirators meeting international standards, (2) masks such as cloth masks and disposable face masks, and (3) face coverings such as bandanas.

†n Values are used as denominators for the percentages below. Percentages can sum to >100 because responses could receive more than one code and/or category.

Conversely, 15 (of 35) residents described not wearing PPE due to the lack of a cue to action, for example because they *didn't think of it/forget.* Issues related to access to PPE included statements such as "wasn't available" and "don't have special protective equipment laying around." Other residents identified *lack of knowledge* concerning the use of PPE; one resident described that they "didn't think [they] needed to wear other PPE."

Self-Efficacy around Mask Fit

Respondents were asked "how do you know that a mask fits?" to explore self-efficacy around PPE use during mold cleanup.

Many responses indicated understanding of important concepts related to donning respirators (Table 3). These were classified under the category "Green Light." Respondents (68/301) often cited concepts relevant to checking for a *seal* between the face and the edges of the respirator (eg, "seals around your face" or "has no gaps"), which are consistent with a user seal check (NIOSH, 2010). Respondents also described that the mask should be *snug or tight* (66/301 respondents) and *cover the nose and mouth* (49/301 respondents). Some described *breathing in or out to check for leaks* (24/301 respondents), presumably through gaps around the edges (eg, "if you blow in it and air comes out, it doesn't fit"). Several residents and workers (24/301 respondents) responded that *fit testing* was how they know that a mask fits, aligning with requirements for workers covered under RPPs. Some mentioned checking for *suction or negative pressure* (18/301 respondents); one resident described that "when you inhale it suctions onto your face."

Some responses were classified under the category "Yellow Light," indicating that they might need clarification to ensure understanding of important concepts related to respirator fit. For example, 22 (of 301) respondents mentioned *squeezing the nose piece*. When donning a filtering facepiece respirator, fingertips from both hands should be used to press down on each side of the nose piece bar (NIOSH, 2010). Some respondents also described that *comfort or ease of breathing* is how they identify good fit (14 respondents); ease of breathing is important for respirator fit but does not indicate whether the respondent understands additional concepts relevant to respirator fit.

Some responses indicate lack of knowledge or misunderstanding of concepts important to respirator fit. These were classified under the category "Red Light." Several respondents (37/301) gave answers referring to *general experience*; for example, a common response to how respondents knew a mask fit was that they "just put it on." A few respondents (7/301) described *discomfort or difficulty breathing* as an indicator of a good fit.

Thirty-two (of 301) respondents, including 5 (of 68) workers, reported that they *did not know* how to identify good fit.

Close-Ended Results around Messaging

For residents, the highest percentage (27%) reported that their main source of information about mold was from the Internet. A similar proportion of workers (26%) reported that their main source of information was from their employers (Table 4). Few residents or workers reported government websites or the health department as a source of mold information.

Most residents (63%) and workers (59%) reported that they had never heard or seen any public messages from the state about cleaning up mold. Among those who had, about two-thirds of residents (67%) and workers (64%) attested that the information was useful to their cleanup efforts.

Most residents (62%) reported that they had never seen any of three existing federal communications materials relevant to mold, mold exposure, and safety practices for cleaning up mold that were shown to them, whereas 41% of workers reported never seeing any of these materials.

Most residents (55%) and workers (69%) responded that social media would be the best way to get messages about mold to the public, followed by television (44% and 41%, respectively) and radio (23% and 31%, respectively).

TABLE 4. Distribution of Responses to Quantitative Questions About Mold Communications Among Residents and Workers, Southeast Louisiana—2021

Question	Resident (n = 238)	Worker (n = 68)
What has been your main source of information about mold?* *n* (%)		
Internet	65 (27)	11 (16)
Figured it out myself	43 (18)	10 (15)
Google	27 (11)	3 (4)
FEMA	21 (9)	8 (12)
Social media	17 (7)	3 (4)
Employer	13 (5)	18 (26)
Health department	13 (5)	11 (16)
Insurance company	12 (5)	3 (3)
Government website	5 (2)	1 (1)
Store	5 (2)	1 (1)
Other	71 (30)	13 (19)
Most common "other" responses		
TV	22 (9)	3 (4)
Word of mouth/social contacts	17 (7)	3 (4)
None/no source of information about mold	16 (7)	1 (1)
Training	2 (1)	4 (6)
Missing	6 (3)	1 (1)
Have you ever heard or seen any public messages from the state, like the health department, or government about cleaning up mold? *n* (%)		
Yes	86 (36)	25 (37)
No	150 (63)	40 (59)
Don't know	2 (1)	1 (1)
Missing	0 (0)	2 (3)
Among those who respond yes: Was this information helpful to your cleanup efforts? *n* (%)		
Yes	58 (67)	16 (64)
No	14 (16)	6 (24)
Don't Know	12 (14)	3 (12)
Missing	2 (2)	0 (0)
Which of these images have you seen before, if any?* *n* (%)		
Image 1: Guide to Mold Clean-up	35 (15)	16 (24)
Image 2: 8 Tips to Clean Up Mold	42 (18)	21 (31)
Image 3: What to Wear	29 (12)	19 (28)
None	147 (62)	28 (41)
Missing	6 (3)	3 (4)
Saw at least 1 image	*85 (36)*	*37 (54)*
Saw all 3 images	*5 (2)*	*7 (10)*
What would be the best way to get messages about mold to the public?*		
Social media	132 (55)	47 (69)
Television	104 (44)	28 (41)
Radio	55 (23)	21 (31)
Text messages	27 (11)	11 (16)
Stores	23 (10)	9 (13)
Mailings	23 (10)	11 (16)
Newspaper	20 (8)	10 (15)
Door-to-door	20 (8)	12 (18)
Classes	13 (5)	11 (16)
Missing	4 (2)	1 (1)
Other	38 (16)	8 (12)
Most common "other" responses		
Internet	10 (4)	1 (1)
Word of mouth/social contacts	4 (2)	1 (1)

*Percentages sum to more than 100 because respondents selected more than one response.
FEMA, Federal Emergency Management Agency.

DISCUSSION

Overall, the findings support the relevance of the HBM constructs for understanding perceptions regarding the use of PPE during mold cleanup. Additionally, the findings related to how respondents obtained information about mold indicate significant remaining opportunity for reaching hurricane- or flood-affected populations with messaging about PPE during mold cleanup.

Qualitative Findings

Exposure or lack of exposure to mold was the dominant explanation respondents offered for why they did or did not feel at risk of sickness from mold. Perceived susceptibility and, to a lesser extent, perceived severity have shown associations with individuals' likelihood of wearing respiratory protection in prior studies of infectious disease.[13] This aligns with research on HBM constructs and health-protective behaviors such as vaccination initiation; perceived susceptibility was significantly associated with behavior more often than perceived severity.[12] Messaging to improve recommended PPE use during mold cleanup could focus on connecting mold exposure to susceptibility to sickness from mold, including how to recognize mold or indoor moisture sources.[23] Additionally, messaging could highlight that mold spores are a health hazard whether viable or nonviable.[2]

Some who did not feel at risk described their perceived low susceptibility as an inherent trait (eg, being "healthy" or "lucky"). Evidence suggests that individuals with certain health conditions (such as those who are immunocompromised or have asthma) are indeed more susceptible to severe health effects of mold exposure[8,24] However, PPE is universally recommended when cleaning mold, regardless of individual risk factors.[6] Some prior research suggests that narrative methods of health education might be more effective than traditional didactic methods, even in the context of recipients' possible over-optimism about their own risk level.[25,26]

Similar to the current study, prior qualitative work found that Houston, Texas, residents after Hurricane Harvey also identified mold as a threat to their health.[10] Unlike the Gandhi and colleagues' study, which was conducted 3 years after a hurricane, our study was conducted only 14 weeks after a hurricane. They used focus groups of a mostly older population with semistructured discussion guides, rather than simple open-ended questions, to investigate perceptions about mold cleanup. They also identified themes of perceived susceptibility and severity of mold-related health issues that overlap with the current study. Disseminating information that alerts hurricane-affected residents and workers of their susceptibility to health effects from mold might increase residents' and workers' perceived threat of health effects from mold exposure. For those conducting mold clean-up in the future, perception changes might improve mold cleanup practices.

Findings indicate that HBM constructs might play a role in decisions about PPE use during mold cleanup, aligning with prior research.[13] Respondents who used PPE during mold cleanup commonly described wanting to avoid mold exposure, perceived benefits of PPE such as personal protection, and concepts relevant to perceived threats such as avoiding sickness. Perceived barriers to PPE usage included discomfort and inconvenience. A few workers perceived low access to PPE, including through their employer. An HBM-guided approach does not robustly model structural factors[12] which might have implications for access. Consequently, a more comprehensive evaluation of residents' and workers' access to PPE for mold cleanup, including access to employer-provided PPE and fit tests for workers, could be informative when selecting interventions intended to increase proper PPE use during mold cleanup. Finally, some residents noted that PPE disuse sometimes occurred because they simply did not think of it. These responses suggest that messaging campaigns might be cues to action. A prior study of coal miners suggested that cues to action including reminders from family or a doctor were associated with an increased likelihood of workers using respiratory protection.[27]

Responses to the question "How do you know a mask fits?" could be relevant to respondents' self-efficacy in using of respirators for mold clean-up.[28] Prior research has shown that self-efficacy around use of respirators was positively associated with intention to use respirators on high air pollution days in a longitudinal survey of young adults in Beijing, China.[29] Respondents to the current study showed understanding of several important concepts related to user seal checks and/or fit tests. Some responses indicated ignorance or misunderstanding about concepts related to respirator use, and messages could reinforce recommendations and counter misunderstandings. For example, facial hair must be limited enough not to interfere with a respirator's seal in order to allow for proper fit[20,30]; workers using a respirator under an RPP are required to be clean-shaven.[19,20] Importantly, several respondents reported that they "don't know" how to assess whether a respirator fits, which might indicate low self-efficacy surrounding respirator use. Although there is no formal system analogous to an RPP to guide nonoccupational respirator use,[20] disseminating messages for the lay public about how to conduct a user seal check[31,32] could help those without access to fit testing increase their sense of self-efficacy, which in turn might increase their likelihood of using recommended respirators during mold cleanup and in other scenarios, such as wildfire smoke events.

Future Message Development

Results suggest that many residents and workers have not heard or seen messages from the state about cleaning up mold; fewer respondents reported having heard public messages about mold in this survey compared to one conducted after Hurricanes Katrina and Rita.[9] Few respondents endorsed that the health department or a government website was their main source of information about mold, and most residents (62%) had never seen any of the offered federal communications materials about mold. These findings suggest that there is opportunity for public health practitioners to reach a wider audience of residents and workers in hurricane-affected areas.

Diverging from some prior work,[10,33] most participants endorsed social media as a good way to disseminate mold-related messages to the public. Emerging research on public entities' social media use for emergency response reveals both opportunities and challenges. For example, new artificial intelligence–based tools could be used (with attentiveness to the challenges of emerging tools[34]) to analyze or generate social media content quickly, but misinformation is also easily spread and difficult to counter on this medium.[35–37] Also, in Hurricane Ida's aftermath, residents and workers faced varying levels of Internet access.[38,39] Communicators could consider multiple strategies, such as message dissemination ahead of the hurricane's landfall.

Residents Versus Workers

Resident and worker responses to the open-ended questions showed some similar patterns. Mold exposure was a common theme in both groups' responses to questions about why they do or do not use PPE, and about why they do or do not feel at risk of health effects from mold.

However, some patterns of worker responses diverged from residents. Unlike residents, workers never mentioned mold remediation as a reason that they did not feel at risk, possibly because workers are engaged in mold remediation as part of their occupation.

A smaller proportion of workers than residents gave responses to the question "How do you know a mask fits?" indicating lack of awareness or misunderstanding of important concepts related to respirator use. This might be because some workers are covered under an RPP, which requires workers who need to use respirators undergo medical clearance, respirator use training, and fit testing, among other components.[20] However, some workers' responses still indicated ignorance or misunderstanding of concepts related to PPE use. Of workers, 7% said they "did not know" how to determine if a mask fits. Some workplaces with a small number of employees, self-employed workers such as freelance handy-people, and some other workers are not covered by RPPs.[20] Reaching out to larger and smaller employers, as well as volunteer organizations, could help ensure that more workers benefit from respirator use, thus protecting them from possible occupational hazards.

Limitations

This study's data relied on a convenience sample, which might not be representative of southeast Louisiana or of all hurricane-affected populations. The predefined sample of respondents, recruited during emergency response, limits our ability to assess for saturation in qualitative responses.[18] Additionally, the survey was designed primarily to identify knowledge, attitudes, and perceptions, and the HBM framework was not incorporated in its design. The mapping of responses onto HBM constructs is post hoc and exploratory, and not a formal test of the HBM. This study can inform messaging relevant to individual perceptions; however, these findings might be less informative regarding how to improve access to PPE. Although a strength of the data collection was its effort to incorporate worker respondents, there may be unmeasured differences in working conditions relevant for perceptions about PPE use across respondents depending on the type and size of their employer; and if unpaid volunteers, what kind of volunteer organization they worked for, if any. Due to the sample size of workers, distinctions in patterns of response between paid workers and volunteers could not be explored; future research could investigate whether these types of workers differ in terms of their knowledge, attitudes, and practices about mold cleanup and PPE use. Future research might consider collecting more detailed information about working conditions and how it might relate to perceptions about PPE use.

CONCLUSIONS

The findings from this study indicate that government messaging about PPE usage is not reaching target audiences and that use of social media to disseminate such messages could be a possible solution. The results affirm that HBM constructs might be relevant to perceptions regarding PPE during mold cleanup, and that perceived susceptibility to sickness from mold could be a fruitful focus for messaging. Knowledge gaps remain regarding proper usage of respirators for occupational and nonoccupational settings. Findings could inform message development for promoting recommended PPE use behaviors among those in hurricane-affected areas.

ACKNOWLEDGMENTS

The authors thank Dr Vidisha Parasram for consultation on qualitative methodological approaches and Dr Laura Syron for her careful review and feedback.

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