ASSESSMENT OF MEDICAL RESERVE CORPS VOLUNTEERS' EMERGENCY RESPONSE WILLINGNESS USING A THREAT- AND EFFICACY-BASED MODEL

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The goal of this study was to investigate the willingness of Medical Reserve Corps (MRC) volunteers to participate in public health emergency-related activities by assessing their attitudes and beliefs. MRC volunteers responded to an online survey organized around the Extended Parallel Process Model (EPPM). Respondents reported agreement with attitude/belief statements representing perceived threat, perceived efficacy, and personal/organizational preparedness in 4 scenarios: a weather-related disaster, a pandemic influenza emergency, a radiological (“dirty bomb”) emergency, and an inhalational anthrax bioterrorism emergency. Logistic regression analyses were used to evaluate predictors of volunteer response willingness. In 2 response contexts (*if asked* and *regardless of severity*), self-reported willingness to respond was higher among those with a high perceived *self-efficacy* than among those with low perceived *self-efficacy*. Analyses of the association between attitude/belief statements and the EPPM profiles indicated that, under all 4 scenarios and with few exceptions, those with a perceived high threat/high efficacy EPPM profile had statistically higher odds of agreement with the attitude/belief statements than those with a perceived low threat/low efficacy EPPM profile. The radiological emergency consistently received the lowest agreement rates for the attitude/belief statements and response willingness across scenarios. The findings suggest that enrollment with an MRC unit is not automatically predictive of willingness to respond in these types of scenarios. While MRC volunteers’ self-reported willingness to respond was found to differ across scenarios and among different attitude and belief statements, the identification of *self-efficacy* as the primary predictor of willingness to respond *regardless of severity* and *if asked* highlights the critical role of efficacy in an organized volunteer response context.

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AFTER THE TERRORIST ATTACKS OF September 11, 2001, there was an influx of motivated but insufficiently organized volunteers, and the US government recognized the need to create a coordinated system for pre-identifying and training qualified volunteers for response during times of community need.¹ The Medical Reserve Corps (MRC), headquartered in the Office of the US Surgeon General, was established in 2002.² The MRC is intended to supplement the current public health workforce and to support community health through the creation and maintenance of a structure to organize, recruit, manage, and train volunteers to respond to community health needs, including those that present after a disaster.³ There is no national-level mandatory training for MRC members, but MRC units are encouraged to use MRC national core competencies, which over 90% do. MRC units have participated in a number of disaster response efforts to date, including Hurricane Gustav, Hurricane Ike, and Tropical Storm Hanna.^{1,4} The MRC's more than 200,000 volunteers, in more than 950 registered units covering over 70% of the United States,^{3,4} represent a critically important cadre of healthcare response personnel in the face of current and future public health and disaster preparedness challenges. However, while the MRC intends to recruit individuals who report a willingness to respond,⁴ different disaster scenarios and contexts that may affect these individuals' willingness to respond after enrollment have not been investigated.

Various risk perception theories and models have been proposed to explain willingness to respond. One such model characterizes risk perception as an additive function of "hazard," as the product of probability of event and risk magnitude, and "outrage," as the variety of factors that influence a person's response to the situation controlling for the actual risk.⁵ However, a study in 2005 found that other factors, including one's "perceived self-importance in an organization," contributed to willingness to respond.⁶ This finding has influenced recent research using the Extended Parallel Process Model (EPPM) to understand willingness to respond in local public health workers, emergency medical technicians, and hospital workers.⁷⁻¹⁰

First introduced by Witte in 1992, the EPPM interprets an effective message as one that conveys 2 equally important parts: threat and efficacy.¹¹ According to the EPPM, messages seeking to encourage protective actions in the face of risk must simultaneously convey (1) that there is a hazard and risk (*threat*) warranting concern, because of a sufficiently high level of perceived *susceptibility* and *severity* attendant to that hazard; and (2) that the desired intervention can be successfully performed by the message's recipient (*self-efficacy*) and that it will be effective in mitigating the impact of the hazard or risk (*response efficacy*). If the message is missing one of these components, the model predicts the message will be rejected because of indifference or fear, respectively.¹¹ Using the EPPM, public health and emergency medical services workers have been found to be significantly more likely to be willing to respond if they fit a "high threat/high efficacy profile."⁷⁻⁹

During the 2009 H1N1 influenza A pandemic, we sought to gauge this cohort's willingness to respond in multiple representative scenarios in the all-hazards spectrum—including pandemic influenza—through a nationwide, EPPM-focused survey of a convenience sample of MRC volunteers. Specifically, we aimed to examine the effects of perceived threat and efficacy, and other public health emergency response attitudes and beliefs, on their willingness to respond in a weather-related disaster, a pandemic influenza emergency, a radiological ("dirty bomb") emergency, and an inhalational anthrax bioterrorism emergency.

METHODS

Ethics Statement

Research ethics approval for the survey and its administration was received from the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (JHSPH IRB) (exempt status # 45 CFR 46.101 (b)(2)). Per JHSPH IRB approval, written consent was not obtained, as the research presented no more than minimal risk to subjects and involved no procedures for which written consent is normally required. The JHSPH IRB-approved study materials included a written disclosure describing the study and emphasizing voluntary participation; verbal consent was not requested or required by the JHSPH IRB for this approved study.

Survey Instrument

The anonymous online survey instrument was made available via SurveyMonkey (SurveyMonkey.com, Portland, OR). The survey included queries on MRC volunteers' demographics and their attitudes and beliefs about public health emergency response. The online survey questions used in the current study were derived from those in the Johns Hopkins Public Health Infrastructure Response Survey Tool (JH~PHIRST).^{7,9} The JH~PHIRST instrument is designed to assess respondents' perspectives regarding public health emergency response roles through the EPPM-based lenses of threat and efficacy, along with other relevant attitude/belief statements. Before the survey was distributed, the National Association of County and City Health Officials (NACCHO) sent an e-mail invitation to all MRC unit leaders describing the survey and asking those unit leaders who were interested in having their MRC unit participate in the survey to respond indicating their intent. NACCHO distributed instructions and the survey link directly to the MRC unit leaders who confirmed their unit's intent to participate. Because of privacy issues, comprehensive listservs for all MRC units' members are not available to the public; therefore, the MRC unit leaders were asked to forward the instructions and link to the survey to

their unit members on behalf of NACCHO and the research team. Participants had access to the online survey from June 22, 2009, through August 1, 2009. A convenience sample was obtained through this approach.

The instrument's attitude and belief statements were intended to identify volunteers' perceptions about different representative public health emergency scenarios in the all-hazards spectrum to inform MRC training program priorities. In its threat and efficacy content, the instrument explicitly incorporated the elements of the EPPM, an extensively validated behavioral model.^{11,12} The attitude and belief statements on the web-based survey were presented with respect to 4 different public health scenarios: a weather-related disaster, a pandemic influenza emergency, a radiological ("dirty bomb") emergency, and an inhalational anthrax bioterrorism emergency. The survey queried participants' perceptions of the likelihood and potential consequences of the scenarios; perceptions of their awareness, skills, and confidence in performing their assigned tasks; their willingness to respond to a public health threat in 2 circumstances (*if asked* and *regardless of severity*); their belief about their safety and that of their family when responding to a public health emergency; and perceived efficacy and importance of their volunteer duties in combating a threat to the public's health. Responses to the attitude and belief statements were based on a 9-point Likert scale with a response of 1 indicating strong agreement with the statement, 9 indicating strong disagreement with the statement, and 5 indicating neutrality. A "don't know" option for each statement was also available. In comparison to the neutral response in the agreement scale (considered ambivalence), the "don't know" response can more likely be considered a lack of knowledge in the statement's area.

The demographic characteristics considered in these models included: gender; age (under 30 years, 30-39 years, 40-49 years, 50-59 years, and 60 or more years); professional classification (physician, EMS professional, mental health professional, nurse practitioner, nurse, pharmacist, physician assistant, dentist, respiratory therapist, veterinarian, other public health/medical, and non-public health/nonmedical); years of membership in the MRC (less than 1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, and more than 5 years); years in the current profession (less than 1 year, 1-5 years, 5-10 years, and more than 10 years); current status (actively licensed/practicing, student, actively licensed/not practicing, retired, and not licensed); and role in MRC (volunteer/member and leader). Several questions (eg, "Do you have a part-time/full-time job in an emergency response role?" and "[Have you] prepared a designated family emergency kit?") required a yes/no response.

Statistical Analysis

Prior to analysis, statement responses were dichotomized into categories of ≤ 4 (positive response) versus ≥ 5 (negative response). Percent of respondent agreement (positive

response) with the statements was calculated for each scenario. Logistic regression analysis was used to determine which demographic factors may be most predictive of a positive response for each of the attitude/belief statements under each of the 4 public health emergency scenarios. Logistic regression analyses were also performed to identify the attitudes and beliefs that were most predictive of either willingness to respond context. EPPM profiles were then created for each scenario based on the original statement responses. These profiles included: low perceived threat (*threat*) of an event and low perceived efficacy in performance of one's volunteer duties (*efficacy*); low threat and high efficacy; high threat and low efficacy; and high threat and high efficacy. The *threat* variable was calculated as the product of the participant's perceived likelihood of the occurrence of the given event (perceived susceptibility) and the perceived severity of the event, while the *efficacy* variable was calculated as the product of their perceived ability to perform their volunteer duties (*self-efficacy*) and their perceived impact on combating the given public health threat (*response efficacy*). Low and high profiles of threat and efficacy were determined by the median values of these 2 cross-products. Logistic regression analysis was then performed on the dichotomized statement responses using the respondent's EPPM categorization as a predictor. Missing and "don't know" responses were excluded from the analyses. All analyses were performed using STATA version 10.1 (STATA Statistical Software, College Station, TX; StataCorp LP, 2009).

RESULTS

A total of 3,181 volunteers from 187 MRC units responded to the survey. Most respondents were female (71%), over 40 years of age (86%), had worked in their present profession for 10 years or more (69%), and were members of the MRC for 2 years or less (52%). The professional categories represented in the highest proportion in the sample were nurse (34%), non-public health/nonmedical (28%), and other public health/medical (11%). These professional categories are fairly representative of the MRC at large: Of the total MRC volunteer population, 28.3% are nurses, 39.2% are non-public health/nonmedical professionals, and 10.1% are other public health/medical professionals. Non-public health professionals include computer specialists, translators/interpreters, public information specialists, administrators/business managers, administrative specialists, communications specialists, legal support, logistics/supplies specialists, drivers, trainers, chaplains, fundraising professionals, ham radio operators, and database and information technology specialists. Fifty-one percent of the respondents were actively licensed and practicing, and 23% were not licensed. Ninety-two percent were volunteers/members compared to leaders, 63% did not volunteer with another organization, and 60% did not have a part-time or full-time job in an emergency response role.

Table 1. Percentage of Positive Responses (Likert score ≤ 4) on Attitude and Belief Statements for 4 Public Health Emergency Scenarios Based on All Responses (excluding “don’t knows”)

<i>Attitude/Belief Statement</i>	<i>Weather-Related Disaster</i>	<i>Pandemic Influenza Emergency</i>	<i>Radiological ("dirty bomb") Emergency</i>	<i>Inhalational Anthrax Bioterrorism Emergency</i>
Perceived likelihood of occurrence in this region	75.2	75.3	33.4	39.3
Perceived severe health consequences likely	72.6	88.2	90.7	87.7
Perceived likelihood of being asked to volunteer for duty	86.7	92.1	82.8	87.3
If asked: self-reported willingness to volunteer for duty	91.7	91.9	81.5	86.5
Perceived knowledge about the public health impact	80.9	90.8	63.2	73.5
Perceived awareness of role-specific responsibilities	63.0	76.7	50.8	63.8
Perceived skills for role-specific responsibilities	79.6	87.9	61.9	74.3
Psychologically prepared	89.4	91.9	66.2	78.5
Perceived ability to safely get to volunteer site	82.7	92.3	61.7	79.7
Confidence in personal safety at volunteer site	84.8	86.8	57.0	74.6
Perceived ability to perform volunteer duties (<i>self-efficacy</i>)	88.5	91.5	67.7	81.5
Perceived that family is prepared to function in absence	85.0	86.8	67.9	76.8
MRC's perceived ability to provide timely information	82.7	88.8	71.7	80.9
Perceived ability to address public questions	78.4	86.0	55.0	67.8
Perceived importance of one's role in the MRC's overall response	83.9	89.5	76.0	84.2
Perceived need for preevent preparation and training	90.9	93.6	89.4	91.3
Perceived need for psychological support during event	63.2	65.4	70.8	68.0
Perceived need for postevent psychological support	65.8	66.9	73.3	70.1
Perceived high impact of one's response (<i>response efficacy</i>)	85.9	89.4	80.0	86.1
Regardless of severity: self-reported willingness to volunteer for duty	89.8	90.8	77.0	85.6

Forty-nine percent of the respondents indicated that they had family members dependent on them during an emergency, and 60% indicated that their family had prepared an emergency kit.

Some demographic characteristics showed statistically significant differences in the responses to the attitude and belief statements when compared to the reference category of the characteristic (data not shown). Whether differences existed, the directions of the differences and the attitudes and beliefs in which the differences occurred were not consistent across scenarios. Two characteristics that had more consistent relationships with positive responses were years volunteering in the MRC, where more years were associated with positive responses compared to those with less than 1 year volunteering, and role in MRC, where being a leader had a stronger association with positive responses, representing agreement, than being a volunteer/member.

“Don’t know” responses ranged from 0.6% to 5.2% for weather-related disaster, 0.3% to 4.8% for pandemic influenza emergency, 1.9% to 10.5% for radiological (“dirty bomb”) emergency, and 1.8% to 8.3% for inhalational anthrax bioterrorism emergency statements. “Don’t know” responses were highest for the radiological (“dirty bomb”) emergency and inhalational anthrax bioterrorism threat. Attitudes and beliefs with the highest percentage of “don’t know” responses included safety, awareness of role-specific responsibilities, ability to address public questions, and ability to perform volunteer duties.

Table 1 provides the percentage of positive responses (ie, Likert score ≤ 4) to, or agreement with, the attitude and belief statements. For all scenarios, the level of agreement for willingness to respond *if asked* was 1 to 5 percentage points higher than for willingness to respond *regardless of severity*. Most respondents indicated a confidence in their knowledge of and impact on combating the 4 public health

threats in the survey. For example, 81% indicated a positive response when asked if they were “knowledgeable about the public health impact of” a weather-related emergency, 91% about a pandemic influenza emergency, 63% about a radiological (“dirty bomb”) emergency, and 74% about an inhalational anthrax bioterrorism emergency. For the same 4 scenarios, 80%, 88%, 62%, and 74% gave a positive response about their “perceived skills for their MRC role-specific responsibilities.” In general, the MRC respondents in the sample were the least positive in their responses for the radiological (“dirty bomb”) emergency scenario. In several instances, responses for this scenario had a notably lower percent agreement than the other scenarios. For example, 57% were confident about their “personal safety at site,” and 55% gave a positive response concerning their “ability to address the questions of a concerned member of the public.” “Perceived awareness of MRC role-specific responsibilities” and “perceived need for psychological support during or after the event” consistently received the lowest percentages of positive responses across all scenarios. For example, 63% of participants responded positively to “perceived awareness of their MRC role-specific responsibilities” for weather-related disaster, 77% for pandemic influenza emergency, 51% for radiological (“dirty bomb”) emergency, and 64% for inhalational anthrax bioterrorism emergency.

The top 5 predictors of a participant’s willingness to respond *if asked* and willingness to respond *regardless of severity* for each of the 4 disaster scenarios and the calculated odds ratios (ORs) are shown in Table 2. Across scenarios, “perceived ability to perform their duties” (*self-efficacy*) was the leading predictor of willingness to respond *if asked* and willingness to respond *regardless of severity*. The odds ratios for all 4 scenarios indicated that those who answered positively to these statements were much more likely to volunteer for duty *if asked* and *regardless of severity* than those who answered negatively. For example, those who answered positively to their “perceived ability to perform their volunteer duties” in a pandemic influenza emergency were 46 times more likely to respond for duty *if asked* and 57 times more likely to respond *regardless of severity* than those who responded negatively to these statements (OR [95% CI] = 45.7 [31.8, 65.8] for *if asked* and 56.9 [39.2, 82.6] for *regardless of severity*).

Table 3 provides the breakdown of the participants in, and the level of willingness to respond by, the 4 EPPM profiles for each scenario. In both volunteering contexts (*if asked* and *regardless of severity*), having a high perceived efficacy profile drew larger percentages of willingness to respond than the low perceived efficacy profile for each of the perceived threat profiles. This underscores the importance of efficacy, particularly self-efficacy, in determining willingness to respond.

Analyses of the association between attitude/belief statements and the EPPM profiles indicated that, under all 4 scenarios and with few exceptions, those with a perceived

high threat/high efficacy (ie, “concerned and confident”) EPPM profile were statistically much more likely to answer positively to the attitude/belief statements than those with a perceived low threat/low efficacy EPPM profile (the reference profile). Reported odds ratios and corresponding 95% CIs for these associations in all scenarios are presented in Table 4. Positive responses on several attitudes and beliefs were similarly more likely to be associated with the “concerned and confident” EPPM profile across all 4 scenarios: perceived likelihood of being asked to respond for duty, perceived importance of one’s role in the MRC’s overall response, and perceived need for pre-event preparation and training. Other attitudes and beliefs that were more likely to be associated with this profile across most of the scenarios were: willingness to respond *if asked*, willingness to respond *regardless of severity*, perceived skills for role-specific responsibilities, and being psychologically prepared. Thus, high levels of efficacy and threat are shown to be associated with other attitude and belief statements hypothesized to influence response willingness. When comparing the 2 EPPM dimensions of perceived threat and perceived efficacy for the 4 scenarios, efficacy generally seemed to have a stronger association with positive responses for the attitudes and beliefs than threat. That is, the odds ratios for answering positively in the perceived low threat/high efficacy and high threat/high efficacy profiles were generally higher (although not usually statistically higher) than those for the perceived high threat/low efficacy profile, where all of these profiles were compared against the perceived low threat/low efficacy profile.

DISCUSSION

Willingness to respond is at the root of an effective MRC response. While the MRC’s intent is to recruit individuals willing to respond in emergency situations, our findings suggest that willingness to respond is more complex than simply registering as a volunteer with the MRC. While between 77% and 91% respondents had positive agreement with willingness to respond *regardless of severity* to the 4 scenarios, our findings indicate that different attitudes and beliefs related to emergency planning and response are unique predictors of willingness to respond *regardless of severity* and willingness to respond *if asked* (Table 2). These findings support research conducted in different occupational cohorts, specifically hospital workers, emergency medical technicians, and local public health workers.⁷⁻¹⁰ Despite seemingly high proportions of willing volunteers, these results indicate that 1 in 10 MRC volunteers are still unwilling to respond *regardless of severity* for a pandemic influenza emergency or weather-related disaster, and 1 in 5 are unwilling to respond *regardless of severity* for a radiological (“dirty bomb”) emergency. These findings suggest that additional efforts are required to increase and sustain the proportion of MRC members willing to respond in a public health emergency.

Table 2. The Top 5 Attitude/Belief Predictors of a Respondent's Willingness to Volunteer for 4 Public Health Emergency Scenarios

Attitude/ Belief Statement	Weather-Related Disaster		Pandemic Influenza Emergency		Radiological ("dirty bomb") Emergency		Inhalational Anthrax Bioterrorism Emergency	
	Willingness to volunteer <i>if asked</i>	Willingness to volunteer <i>regardless of severity</i>	Willingness to volunteer <i>if asked</i>	Willingness to volunteer <i>regardless of severity</i>	Willingness to volunteer <i>if asked</i>	Willingness to volunteer <i>regardless of severity</i>	Willingness to volunteer <i>if asked</i>	Willingness to volunteer <i>regardless of severity</i>
	Rank ^a (OR) ^b	Rank (OR)	Rank (OR)	Rank (OR)	Rank (OR)	Rank (OR)	Rank (OR)	Rank (OR)
Perceived likelihood of being asked to volunteer for duty	3 (29.6)		2 (39.5)		2 (17.1)		4 (22.3)	
Psychologically prepared	2 (30.8)	3 (26.4)	3 (35.7)	2 (35.3)	3 (14.6)	2 (14.7)	2 (26.2)	3 (23.8)
Perceived ability to safely get to volunteer site		5 (20.9)	5 (28.0)	3 (27.6)	5 (11.2)	5 (12.6)	5 (19.8)	5 (21.3)
Confidence in personal safety at volunteer site				5 (22.5)	4 (12.4)	4 (13.4)	3 (24.1)	2 (24.3)
Perceived importance of one's role in the MRC's overall response	5 (27.3)	4 (23.0)						
Perceived need for preevent preparation and training	4 (28.2)	2 (26.8)	4 (30.3)	4 (25.8)				
Perceived ability to perform duties (<i>self-efficacy</i>)	1 (38.2)	1 (35.4)	1 (45.7)	1 (56.9)	1 (20.7)	1 (23.1)	1 (32.5)	1 (30.1)
Perceived high impact of one's response (<i>response efficacy</i>)						3 (14.4)		4 (21.3)

^aPredictor statements are ranked 1-5, with 1 having the strongest association. Rankings are based on the magnitude of the odds ratio (OR).^bAll ORs in the table are statistically significant at $p \leq 0.05$.

Table 3. Frequency of Individuals In and Percentage of Individuals Willing to Volunteer by Profiles of the Extended Parallel Process Model (EPPM) for 4 Public Health Emergency Scenarios

Emergency Scenario	Low Threat, Low Efficacy			Low Threat, High Efficacy			High Threat, Low Efficacy			High Threat, High Efficacy		
	% of Total in Profile	% Willing to Volunteer if asked, but not required	% Willing to Volunteer regardless of severity	% of Total in Profile	% Willing to Volunteer if asked, but not required	% Willing to Volunteer regardless of severity	% of Total in Profile	% Willing to Volunteer if asked, but not required	% Willing to Volunteer regardless of severity	% of Total in Profile	% Willing to Volunteer if asked, but not required	% Willing to Volunteer regardless of severity
Weather-related disaster	34.3	82.4	78.0	15.8	98.8	98.5	21.9	94.1	91.9	28.1	98.6	98.6
Pandemic influenza emergency	35.9	84.8	82.5	16.4	97.7	96.9	18.6	94.0	90.0	29.2	97.9	99.0
Radiological ("dirty bomb") emergency	36.0	66.5	58.8	18.0	94.9	95.7	18.4	84.0	70.6	27.7	96.7	96.4
Inhalational anthrax bioterrorism emergency	41.0	76.7	74.9	13.8	98.6	98.2	17.6	86.9	82.4	27.6	97.8	98.0

Our findings reveal that "perceived ability to perform one's duties (*self-efficacy*)" is the leading predictor of response willingness across scenarios and response contexts (Table 2). This study takes advantage of the perceived threat and efficacy dimensions of the EPPM to understand the cognitive and affective dynamics of response willingness. Using the EPPM, we can understand how an individual MRC volunteer's degree of concern (*threat*) and confidence in his or her ability to respond and perceived impact on response (*efficacy*) may affect his or her willingness to respond. This finding underscores the utility of the EPPM as a lens for understanding willingness to respond and highlights the critical importance of the EPPM's efficacy dimension in this regard. The particular importance of efficacy in willingness to respond is further reflected by the observation that the percentage of respondents willing to respond *regardless of severity* and *if asked* for those with a low threat/high efficacy level is comparable to those with a high threat/high efficacy profile across scenarios (Table 3). This situation occurs regardless of threat level, willingness to respond context, and scenario.

After years of high-profile messaging to warn responders and the public of the real threat associated with potential public health emergencies, these results suggest that MRC volunteer response capacity may be enhanced by interventions focused on improving efficacy—both in terms of increasing volunteers' confidence in performing their emergency duties (*self-efficacy*) and boosting their awareness that their individual volunteer participation makes a positive impact (*response efficacy*). With regard to *self-efficacy*, building role-specific understanding is acutely important since awareness of role-specific responsibilities consistently displayed one of the lowest percent agreements of all attitude and belief statements across all 4 scenarios (Table 1). With respect to *response efficacy*, as any amount of additional assistance will make a difference in response to a public health emergency, the first step is to better educate MRC volunteers as to their designated roles during the studied emergency scenarios and then motivate them with an understanding of why this role makes a difference. If a specific designated role cannot be predetermined, a set of potential roles should be defined and adequately introduced to all relevant volunteers to ensure that they feel confident in their ability to perform their duty and perceive it as important.

This study also explored a variety of attitude and belief statements hypothesized to influence response willingness (Tables 1 and 3). During a pandemic influenza emergency, 13% of respondents indicated that they did not perceive their family to be prepared to function in their absence, and 13% of respondents indicated that they did not have confidence in their own personal safety while responding (Table 1). These insights support findings from a recent survey conducted by the US government that looked at the tasks the MRC perceives it would perform in a pandemic and the barriers associated with response. MRC units

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Table 4. Reported Odds Ratios (OR) and Corresponding 95% Confidence Intervals (CI) for Associations Between Positive Responses on the Attitude and Belief Statements and the Extended Parallel Process Model (EPPM) Profiles for 4 Public Health Emergency Scenarios

Attitude/Belief Statement ^a	EPPM Profile ^{b,c}	Weather-Related Disaster OR (95%CI)	Pandemic Influenza Emergency OR (95%CI)	Radiological (“dirty bomb”) Emergency OR (95%CI)	Inhalational Anthrax Bioterrorism Emergency OR (95%CI)
Perceived likelihood of being asked to volunteer for duty					
	LT/HE	4.2 (2.9-6.2)	6.4 (3.6-11.3)	5.7 (3.8-8.4)	6.4 (3.6-11.4)
	HT/LE	7.4 (4.9-11.1)	4.9 (3.0-8.0)	4.5 (3.1-6.4)	6.2 (3.7-10.3)
	HT/HE	21.2 (12.0-37.4)	50.8 (16.1-160.0)	30.1 (15.8-57.3)	34.2 (14.0-83.8)
If asked: self-reported willingness to volunteer for duty					
	LT/HE	17.2 (7.0-42.2)	7.7 (3.9-15.3)	9.4 (5.8-15.2)	20.8 (7.7-56.5)
	HT/LE	3.4 (2.3-5.0)	2.8 (1.8-4.3)	2.6 (1.9-3.6)	2.0 (1.4-2.9)
	HT/HE	15.1 (7.9-29.0)	8.2 (4.8-14.2)	14.6 (9.0-23.6)	13.7 (7.6-24.9)
Perceived knowledge about the public health impact					
	LT/HE	3.5 (2.5-4.7)	4.5 (2.8-7.4)	4.6 (3.5-6.2)	3.7 (2.6-5.4)
	HT/LE	6.1 (4.5-8.5)	6.6 (3.9-11.4)	2.2 (1.7-2.8)	2.0 (1.5-2.6)
	HT/HE	18.1 (11.7-28.1)	20.0 (9.8-41.0)	9.5 (7.1-12.9)	9.1 (6.3-13.2)
Perceived awareness of role-specific responsibilities					
	LT/HE	2.9 (2.3-3.8)	3.8 (2.8-5.2)	5.5 (4.2-7.3)	5.6 (3.9-8.0)
	HT/LE	2.4 (1.9-3.0)	2.0 (1.5-2.6)	1.7 (1.3-2.2)	1.6 (1.2-2.0)
	HT/HE	6.5 (5.1-8.3)	8.5 (6.1-11.7)	10.2 (7.8-13.3)	9.7 (7.1-13.3)
Perceived skills for role-specific responsibilities					
	LT/HE	6.3 (4.3-9.0)	6.4 (3.9-10.6)	8.4 (6.1-11.6)	9.7 (5.9-16.0)
	HT/LE	3.5 (2.7-4.5)	2.3 (1.7-3.2)	1.6 (1.2-2.0)	1.8 (1.3-2.3)
	HT/HE	10.5 (7.4-14.8)	26.6 (13.0-54.3)	14.3 (10.4-19.7)	17.3 (11.0-27.4)
Psychologically prepared					
	LT/HE	11.5 (6.0-21.9)	17.2 (7.0-42.3)	8.4 (5.9-11.9)	10.2 (5.6-18.5)
	HT/LE	4.1 (2.9-6.0)	5.3 (3.2-8.7)	1.3 (1.0-1.7)	1.2 (0.9-1.6)
	HT/HE	20.5 (10.8-39.1)	51.5 (16.4-162.1)	13.0 (9.3-18.3)	11.8 (7.4-18.7)
Perceived ability to safely get to volunteer site					
	LT/HE	7.0 (4.5-10.8)	7.9 (4.0-15.7)	7.0 (5.1-9.5)	5.8 (3.6-9.3)
	HT/LE	2.4 (1.8-3.1)	3.5 (2.2-5.7)	1.4 (1.1-1.8)	1.3 (0.9-1.7)
	HT/HE	6.6 (4.7-9.3)	11.6 (6.2-21.6)	11.8 (8.7-16.0)	9.2 (6.0-14.1)
Confidence in personal safety at volunteer site					
	LT/HE	10.1 (6.0-17.0)	7.4 (4.3-12.7)	7.8 (5.7-10.4)	11.8 (6.7-20.5)
	HT/LE	3.0 (2.2-4.0)	1.6 (1.2-2.2)	1.3 (1.0-1.7)	1.3 (1.0-1.7)
	HT/HE	9.4 (6.4-14.0)	8.0 (5.2-12.2)	10.3 (7.8-13.7)	9.6 (6.6-14.0)
Perceived that family is prepared to function in absence					
	LT/HE	5.3 (3.4-8.1)	5.5 (3.4-8.9)	7.0 (5.0-9.8)	8.0 (4.9-13.2)
	HT/LE	2.1 (1.6-2.8)	2.0 (1.5-2.8)	1.6 (1.3-2.1)	1.4 (1.1-1.8)
	HT/HE	7.0 (4.8-10.2)	6.3 (4.3-9.4)	9.1 (6.7-12.4)	6.1 (4.4-8.5)
MRC’s perceived ability to provide timely information					
	LT/HE	5.6 (3.7-8.3)	6.1 (3.6-10.3)	7.0 (4.8-10.0)	7.7 (4.4-13.5)
	HT/LE	2.0 (1.6-2.6)	2.5 (1.7-3.6)	1.4 (1.1-1.8)	1.6 (1.2-2.2)
	HT/HE	9.7 (6.6-14.4)	9.4 (5.8-15.2)	9.5 (6.8-13.3)	6.4 (4.4-9.4)
Perceived ability to address public questions					
	LT/HE	5.7 (4.0-8.0)	4.1 (2.7-6.0)	5.8 (4.3-7.7)	4.3 (3.0-6.1)
	HT/LE	3.0 (2.3-3.9)	2.9 (2.1-4.1)	1.3 (1.1-1.7)	1.6 (1.3-2.1)
	HT/HE	11.5 (8.1-16.3)	9.4 (6.2-14.5)	8.9 (6.8-11.6)	7.2 (5.3-9.7)
Perceived importance of one’s role in the MRC’s overall response					
	LT/HE	11.4 (6.8-19.2)	22.0 (9.0-53.9)	21.3 (12.2-37.0)	27.4 (10.1-74.5)
	HT/LE	2.4 (1.8-3.1)	2.4 (1.7-3.5)	2.1 (1.6-2.7)	2.2 (1.6-3.1)
	HT/HE	27.4 (15.2-49.3)	66.2 (21.0-208.0)	59.0 (28.9-120.4)	56.0 (20.7-151.5)
Perceived need for preevent preparation and training					
	LT/HE	6.9 (4.0-11.9)	8.5 (4.1-17.6)	6.8 (4.0-11.3)	13.1 (5.3-32.2)
	HT/LE	6.5 (4.1-10.3)	7.7 (4.0-14.8)	5.2 (3.3-8.3)	6.3 (3.5-11.3)
	HT/HE	31.6 (13.9-71.7)	30.8 (11.3-83.9)	36.8 (15.0-90.1)	16.5 (8.1-33.9)

(continued)

Table 4. (Continued)

Attitude/Belief Statement ^a	EPPM Profile ^{b,c}	Weather-Related Disaster OR (95%CI)	Pandemic Influenza Emergency OR (95%CI)	Radiological (“dirty bomb”) Emergency OR (95%CI)	Inhalational Anthrax Bioterrorism Emergency OR (95%CI)
Perceived need for psychological support during event					
	LT/HE	2.1 (1.6-2.6)	1.8 (1.4-2.3)	1.9 (1.4-2.5)	1.7 (1.2-2.2)
	HT/LE	2.3 (1.8-2.9)	1.9 (1.5-2.5)	2.4 (1.8-3.2)	2.2 (1.6-2.9)
	HT/HE	3.7 (2.9-4.6)	2.6 (2.1-3.3)	3.7 (2.8-4.8)	2.2 (1.7-2.8)
Perceived need for postevent psychological support					
	LT/HE	2.1 (1.6-2.7)	1.7 (1.3-2.2)	1.7 (1.3-2.3)	2.0 (1.4-2.7)
	HT/LE	2.3 (1.8-2.8)	2.0 (1.6-2.6)	2.2 (1.6-2.9)	2.0 (1.5-2.6)
	HT/HE	3.7 (3.0-4.6)	2.8 (2.2-3.5)	3.9 (3.0-5.2)	2.3 (1.8-3.0)
Regardless of severity: self-reported willingness to volunteer for duty					
	LT/HE	18.9 (8.3-43.0)	6.7 (3.7-12.1)	15.4 (9.1-26.0)	18.3 (7.5-44.9)
	HT/LE	3.2 (2.3-4.5)	1.9 (1.3-2.7)	1.7 (1.3-2.2)	1.6 (1.1-2.2)
	HT/HE	20.0 (10.5-38.0)	20.9 (9.7-45.0)	18.9 (11.8-30.2)	16.3 (8.8-30.2)

^aStatements used to define EPPM profiles are not included.

^bLT is Low Threat; LE is Low Efficacy; HT is High Threat; HE is High Efficacy.

^cLT/LE is reference category for calculation of OR (95%CI).

surveyed in September 2009 reported the potential to be involved in more than 20 different activities related to the 2009 H1N1 influenza A pandemic, including participating at vaccination clinics, assisting with the distribution of antivirals, supporting the Strategic National Stockpile, assisting with medical triage, and staffing public health call centers. However, this same MRC survey noted 293 responses of significant barriers to actual volunteer response. Of note, 20 of the barrier responses reflected volunteers' concerns that they or a family member might develop the illness.¹³ These findings also support earlier observations of the unwillingness of some health workers to respond to HIV/AIDS in the early 1980s and to the 2003 SARS epidemic if they perceived risk of exposure to themselves or family members.¹⁴

Our findings reveal an especially pronounced deficit in willingness to respond to a radiological public health emergency event—in this case, a radiological “dirty bomb” emergency (ie, a radiological dispersal device, or RDD). With regard to this scenario, respondents consistently indicated lower willingness to respond *regardless of severity* and *if asked*, along with consistently lower rates of agreement with relevant attitude and belief statements than for the other scenarios. This indicates that efforts and interventions should be targeted to boost MRC members' willingness and confidence in volunteering for response to this type of threat (Tables 1 and 3). Only 63% responded positively regarding their “perceived knowledge about the public health impact” of a radiological (“dirty bomb”) emergency. Half of the survey participants (51%) responded positively regarding their “perceived awareness of their own role-specific responsibilities” in such an event. These positive response rates were the lowest of all surveyed scenarios for these statements.

Moreover, participants' responses to other attitude/belief statements suggest that their *actual* knowledge and awareness of the public health impact and role-specific responsibilities in a radiological emergency may be even lower than their *perceived* knowledge. For example, 91% of the respondents “perceived that severe health consequences are likely” after an emergency involving a “dirty bomb,” compared to 73% for the weather emergency scenario. In fact, the number of casualties expected from such a device will be limited to the site of the explosion, and the radiological hazard is unlikely to cause severe or any health effects beyond the immediate vicinity of the incident.¹⁵ Therefore, the highest percentage of positive responses regarding the likelihood of severe health consequences (91%) indicates some degree of misconception about the true public health impact of this scenario.

Of note, the radiological scenario had lower agreement rates for “perceived knowledge about the public health impact,” “awareness of role-specific responsibilities,” “ability to perform volunteer duties,” “ability to provide timely information,” “need for pre-event preparation and training,” and “ability to address public questions.” Meanwhile, respondents had relatively higher rates of agreement with “perceived need for psychological support during event and post-event” for the radiological scenario. This observation is consistent with a sense of helplessness, fatalism, or futility that is sometimes associated with incidents involving radiation or radioactive materials.^{16,17} In focus group testing of knowledge, attitude, and behaviors related to radiation, research has shown that people have a tendency to believe there is little they can do in response to a radiation incident and that, once a person is contaminated with radioactive materials, the person is doomed.¹⁸ It appears that the lower perceived *self-efficacy* in case of a

radiological emergency does not result in a greater perceived need for training in that area. Instead, there is a greater perceived need for psychological support.

A low percentage of respondents perceived the occurrence of a radiological emergency in their region as likely (33%). The fact is that a “dirty bomb” event can affect a large area, depending on weather conditions and the type of radioactive material and the amount of explosives used.¹⁹ Thus, there is the potential for a single “dirty bomb” to displace a large population, especially if the incident happens at or near areas of high population density. A community located far away from a radiological emergency may receive a portion of this evacuee population for whom the community needs to provide assistance, including shelter. The local health departments and local MRC units in the host community can contribute to the effectiveness of the community response to such an emergency. Therefore, if a radiological “dirty bomb” emergency happens anywhere in the country, the likelihood for needing MRC assistance in host communities all around the country will be high. It appears that many MRC members may not have taken this possibility into consideration, which further underscores the need for radiation-specific training focused on role-specific responsibilities for MRC volunteers.

Many MRC units are affiliated with local health departments in their community. There is consensus that local health departments lack sufficient awareness and understanding of public health responsibilities in a nuclear or radiological emergency.²⁰ Local health departments also generally lack radiation subject-matter expertise or specific funding to train, plan, and conduct radiological emergency drills or participate in regional exercises. Recent research has shown local public health workers also exhibit lower levels of willingness to respond in radiological events.⁹ Our survey findings are consistent with these observations. Any attempt to improve *self-efficacy* among MRC members by building role-specific understanding in any emergency has to be coupled with similar attempts to train and plan at local public health departments with which those MRC units are affiliated.

While efficacy carries particular weight in this regard, our findings also suggest the value of campaigns focused on the threat components of preparedness volunteer messaging, when coupled with an efficacy message. For the pandemic influenza emergency scenario, the odds ratios of high threat/high efficacy profiles were notably higher than low threat/high efficacy profiles when both are compared to the low threat/low efficacy (reference group) for willingness to respond *regardless of severity* (Table 4). The relative weight of efficacy in willingness to respond may be an important and scenario-dependent finding. This is further supported by recent research that has shown a health cohort to have lower perceived levels of importance in emergency response in a severe earthquake compared to a pandemic.²¹ However, the threat component of the EPPM may also be an important contributor to willingness to respond and should not be ignored in future programmatic interventions.

There are certain limitations to this study that must be acknowledged. First, the number of participants (3,181) is a small, but relatively representative, sample of the larger pool of MRC volunteers. A higher number of responses might have been achieved with better survey distribution and timing. For example, the online survey was open for 5 weeks during summer while the H1N1 novel influenza response was ongoing.

Second, the sampling strategy was one of convenience. MRC could not, because of their own limitations, formally disseminate this survey to its members. Thus, Johns Hopkins and NACCHO took the lead in survey administration, with a simple endorsement from the MRC. The initial invitation to participate in the survey went to all MRC unit leaders, and interested MRC leaders were asked to RSVP to NACCHO by a certain date. Once the RSVP date was reached, a link to the survey was sent to each of the MRC leaders. MRC leaders were asked to disseminate the link to their membership, but completion of this step by unit leaders is not known. As a result, the authors do not know the number of MRC volunteers who received the survey and are missing the denominator necessary to calculate an overall response rate. Given the above-mentioned limitations of the MRC to directly distribute surveys to its constituent units, this consideration would continue to apply to future surveys of this cohort. Although this is unfortunate, the intent of the research was not to draw conclusions about the willingness to respond of the MRC at large, but to gain insights and familiarity with issues specific to response willingness among members of the MRC.

Third, while we have tried to minimize social desirability bias in the construction and phrasing of the survey instrument content, this survey-based study is not necessarily predictive of actual behavior during an event. Moreover, findings from a recent survey of individuals living in the National Capital Region indicated that increased perceived radiation hazard magnitudes were associated with increased perceived risk. This study does not account for differences in severity of scenario and may be biased by the respondent's prior experience with a scenario.²²

Fourth, the findings from our study of MRC volunteers may not necessarily translate to similar findings among volunteers in different volunteer organizations. Indeed, this is an area worthy of further comparative research study.

Fifth, to make the instrument appropriate for a volunteer cohort, we intentionally changed the phrasing from the source survey (Johns Hopkins ~ Public Health Infrastructure Response Survey Tool; JH ~ PHIRST)^{7,9} from “willingness to respond” to “willingness to volunteer”; this rephrasing may theoretically limit the appropriateness of direct comparison with nonvolunteer responders previously examined in the public health emergency preparedness system.⁷⁻¹⁰

Finally, this entire study took place during the 2009 H1N1 influenza A pandemic. Secondary to this pandemic, among other activities, MRC units surveyed were actively

involved with testing and exercising plans for mass dispensing, mass vaccination, school-based vaccination, medical surge for hospitals, alternative care facilities, and health clinics and quarantines.¹³ This training and exercising may have led to heightened awareness and encouraged an exaggeration of attitudes and beliefs for the pandemic influenza emergency scenario compared to the response that would be expected in a nonpandemic context.

CONCLUSIONS

Our findings suggest that *self-efficacy* is a consistent and critical determinant of response willingness in the MRC cohort. Moreover, the threat and efficacy dimensions of the EPPM provide an effective and appropriate model for understanding, and potentially improving, willingness to respond among MRC volunteers. Enrollment or registration with an MRC unit is not automatically predictive of willingness to respond in these types of scenarios. While MRC volunteers' relationship between self-reported willingness to respond and public health emergency response attitude/belief statements differed across scenarios, the identification of *self-efficacy* as the primary predictor of willingness to respond *regardless of severity* and *if asked* highlights the critical role of efficacy in an organized volunteer response context. Interventions aimed at efficacy development in MRC volunteers have the potential to enhance MRC volunteer presentation at public health emergencies and to increase the efficiency and effectiveness of MRC response. A larger study should be conducted on MRC volunteers' response willingness given these intriguing and informative findings.

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