

Responder Safety in Austere Conditions

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## Abstract

The response effort is one of the most critical and strenuous phases of emergency management for both victims, as well as responders. However, unlike victims, responders are often subject to these conditions much more often and receive less support for their recovery. Many responders feel as if they aren't given enough time to recover between responses, and many choose not to receive assistance for various reasons. However, this has led to statistically higher cases of mental disturbances caused by the trauma responders face, as well as lasting physical ailments and diseases that may lead to reduced mental health. Studying the experiences of first responders reveals that they are aware of increased hazards when responding to austere conditions.

They also believe that studying responder injuries in austere conditions can help improve the safety of responses, and educating responders can prepare them for austere responses when they occur. Collecting data about responders' injuries in austere conditions would allow emergency managers to improve the safety of both inexperienced and experienced first responders.

*Key words:* Austere, Responders, Disaster

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## Chapter I: Introduction

The response effort is the most immediate reaction following a disaster, and is often begun by individuals known as first responders. These people are the first to arrive on the scene, and are often subjected to the most hazardous conditions, both physically and mentally. Their involvement in such uncontrolled disasters may expose them to physically harmful conditions, like airborne carcinogens, without proper personal protective equipment, or mentally stressful scenes. While these situations often have lasting physical and mental effects for the victims involved, they also prove to be especially dangerous to first responders, who in some cases may have more acute exposure to such conditions than the victims themselves. Furthermore, for various reasons, these same first responders are less likely to receive the assistance needed to recover from these experiences they face, and many display signs that it has a negative impact on their mental health. Two primary studies have revealed that responders are up to ten times more likely to contemplate suicide than the average American adult, and it was also found that nearly thirty percent believed life was no longer enjoyable (Luster, 2022). A Delphi study conducted at Elizabeth City State University revealed that professionals in emergency management also felt that emergency responders are at a heightened risk of long term injuries or illnesses.

### 1.1 Purpose Statement

This thesis covers the difficulties that first responders face when working in austere conditions, and how data collected on this subject can make response efforts safer. The research conducted prior to the Delphi study used in this thesis reveals the effects that the environment around first responders can have. Chronic illnesses have been found to impact responders' decades after exposure to such conditions. For example, respiratory conditions stemming from

pollutant inhalation during the attacks on the World Trade Center on September 11, 2001, have been reported in responders as recently as December of 2022 (*Program Statistics - World Trade Center Health program, 2023*).

## 1.2 Problem Statement

The study used in the research reveals that injuries among responders are more likely in instances where the responders have not received proper training and experience, or personal protective equipment. However, despite there being documentation for a select few specific incidents, such as the aforementioned World Trade Center attacks, there is a distinct lack of documentation for injuries in more common responses, such as building fires, or rescues in austere climates. The result is that it becomes more difficult to perform case studies of such incidents, and more difficult to improve upon the safety measures that take place for responders. In addition, many responders who have suffered injuries or developed illnesses due to the nature of their response do not seek or maintain treatment following the incident. Psychological trauma is one of the primary effects that responders suffer from, and while it is extensively documented in incidents that track responders, such as the WTC Health Program, other responders do not report their well-being. Responders show disproportionately higher rates of suicidal thoughts and actions when compared to typical Americans, however the route cause for responders has not been widely discussed.

## Chapter II: Literature Review

### 2.1 Documenting Chronic Effects

One of the most documented examples in which first responders were subject to austere conditions was during the response to the World Trade Center terrorist attacks. Aside from the thousands of lives that were lost from the initial impact, fires, and collapsing of the towers, many responders have suffered illnesses relating to the disaster decades after their initial exposure. One of the primary databases used to track responders and victims directly affected by the incident is the World Trade Center Health Program (WTC Health Program). This program is designed to assist responders and victims who have suffered medically from the disaster, as it recognizes the condition they have developed, how many people enrolled have developed it, and the demographics of those enrolled. The program has determined that around 74 percent of responders in the program have been diagnosed with a physical or mental health condition directly linked to 9/11 (WTC Health Program). The most prevalent disease is rhinosinusitis, with 35 percent of the registered responders developing this disease. Approximately 32 percent of responders developed gastroesophageal reflux disease (GERD), and 19 percent have developed some form of cancer, with prostate cancer being the most common among male responders (*Program Statistics - World Trade Center Health program, 2023*). These conditions primarily stemmed from the inhalation of dust and toxins from the damaged towers, as a lack of sufficient protective equipment meant that responders inhaled toxic fumes from the debris and came into contact with carcinogens during the effort (Haelle, 2021). One important factor was the general lack of respiratory protection. A study jointly conducted by NYC Fire Department's Bureau of Health Services and CDC's National Institute for Occupational Safety and Health concluded that, of 119 participating firefighters that were present during the collapse of the towers, 67 wore any

form of respiratory protection. Of the 130 present on the first day of the incident, 76 wore a disposable respirator mask (MMWR, 2002).

## 2.2 Other Documentation of Injuries

Outside of the World Trade Center attacks, the wellbeing of responders following their work in austere conditions is sparsely documented; accounting for conditions developing from responses is often not considered. A lack of documentation for injuries related to austere conditions poses a problem for organizations wishing to improve the safety of the response effort, and reduce the chronic illnesses directly linked to the profession. In order to help combat the tracking deficiencies, some responders' deaths and injuries, such as firefighters and paramedics, are tracked through the National Institute of Occupational Safety and Health (NIOSH). The organization has conducted a study, in collaboration with the National Cancer Institute and the Department of Public Health Sciences in the University of California, that determined firefighters in the states of Chicago, Philadelphia, and San Francisco have significantly higher rates of cancer (Centers for Disease Control and Prevention, 2013). The study used the cancer rates of 29,993 workers from the fire departments of the states, between the years of 1950 and 2009, although the conditions which lead to the development of cancers in firefighters are not monitored by individual cases.



## Chapter III: Methodology

### 3.1 Survey Introduction

The results of this study were obtained using a three-round Delphi study. Subject matter experts were given three rounds of questions that assessed the expert's judgment of safety in first responders when working in austere conditions. The goal of the study was to reach a consensus when considering the additional risk posed by austere conditions, specific groups of responders who may be more vulnerable to injuries, and what can be done to collect data on the subject. The participants were composed of 10 subject matter experts; individuals that regularly serve as responders in areas that are normally hospitable but become austere during and after the disaster occurs.

The first round of the survey consisted of 16 questions, from which 12 questions asked participants to select the level that they agreed with statements from a scale ranging from 1 to 10. The level 1 signified the most disagreement with the statement given, and numerically higher values represented a stronger agreement with the listed statement. A consensus from the respondents was achieved if at least 80% of the respondents agreed or disagreed to each question, while a 70% agreement rate suggested a partial concurrence. These questions were designed for the respondents to express their level of agreement about questions directly related to responding in austere conditions. The latter 4 questions were written response questions that required the respondents to think critically about improving the response in austere conditions and collecting suggestions about such topics.

The second round of the survey consisted of 14 questions, taken from the 16 used in the first round. In this survey, however, 2 of the written questions were removed, and respondents were now allowed to see the averages and standard deviations of the results from the previous

round. The goal in doing so was to allow the respondents to reflect upon their previous responses, as well as the general opinion about each question held by the group as a whole. The third round consisted of 5 questions, with the questions that had somewhat high standard deviations being included, as well as 3 written response questions used in the previous rounds.

Below are the survey questions used for the Delphi Study, distributed through Microsoft Forms to the 10 respondents, whose responses remain anonymous.

### 3.2 Table of Survey Questions

Table 3.2 *Survey Question List*

<b>Question Number</b>	<b>Survey Question List</b>	<b>Question Type</b>
1	There is a greater risk of injury to responders in austere conditions created by disaster situations than there are to them in normal daily emergency operations.	1-10 Scale
2	There is a greater risk to responders for illness in response to austere conditions caused by disaster than in normal daily emergency responses	1-10 Scale
3	There is a greater risk to responders for developing chronic or long-term health conditions from responding to disasters in austere conditions than that of their normal daily operations.	1-10 Scale
4	Professional emergency	1-10 Scale

Question Number	Survey Question List	Question Type
	responders operate safer in austere disaster conditions than they do in normal daily emergency situations?	
5	Trained volunteer responders tend to take on more risk when responding to a disaster in austere conditions than they normally would.	1-10 Scale
6	Untrained spontaneous volunteers take more risk when responding to emergencies in a disaster in austere conditions than they normally would?	1-10 Scale
7	There are there more real hazards and risks for responders when responding in a disaster austere condition versus daily operations?	1-10 Scale
8	Emergency responders typically perceive an increase in hazards and risks when working in austere conditions.	1-10 Scale
9	To what extent does the sense of urgency of a disaster in austere conditions cause responders to accept more risk in their task?	1-10 Scale
10	To what extent does limited resources in responding to a disaster in austere conditions cause a responder to accept more risk in the tasks?	1-10 Scale
11	Would a centralized site for voluntarily tracking injuries to responders in austere and disaster situations be useful to	1-10 Scale

Question Number	Survey Question List	Question Type
	the emergency service professions?	
12	Would a centralized mandatory reporting database for injuries and disaster in austere conditions to responders be beneficial to emergency service fields?	1-10 Scale
13	What would be the Most important pieces of information to collect in such a database	Written Response
14	What do you see as the most important hazards and risks to educate responders about for responding in austere disaster conditions for their safety?	Written Response
15	Are you aware of any organization or data sites that specifically tracks injuries to responders while working in austere or disaster conditions?	Written Response
16	Do you have any other information or areas that you think are of major concern as we move forward studying responder safety in austere conditions?	Written Response

## Chapter IV: Study Results

The results of the Delphi Study convey that the respondents generally agree that austere conditions exacerbate the response effort. The overall high average score of question 2 shows that there is consistent agreement that austere conditions present a greater risk to responders. The level of concurrence, based upon the number of respondents who agreed to each statement, was higher in questions that suggested the additional risks posed to responders by austere conditions. The data provided was taken after all rounds had been completed. In some cases a consensus was reached prior to the final round, in which case that question would be removed from the following round. The agreement/disagreement questions were given a scale of 1-10, with a higher mean suggesting a greater level of overall agreement among the respondents. 10 out of the 12 scaled questions arrived at a consensus at the end of the final round, while one of the questions arrived at a consensus during the first round, but not after the second or third. Written responses were optional, and not all respondents replied to every written response question, leading to inconsistencies in the number of responses provided for each question. Despite this, there are still similarities in the opinions held by the responders who provided written responses.

### 4.1 Data Analysis

Below is a list of the data provided for each of the agreement/disagreement questions used in the Delphi Study.

Table 4.1 *Survey Question Data*

<b>Survey Question List</b>	<b>Question Data</b>	<b>Question Type</b>
There is a greater risk of injury to responders in	Mean: 8.9 Consensus Achieved?: Yes	1-10 Scale

Survey Question List	Question Data	Question Type
austere conditions created by disaster situations then there are to them in normal daily emergency operations.		
There is a greater risk to responders for illness in response to austere conditions caused by disaster than in normal daily emergency responses	Mean: 8.44 Consensus Achieved?: Yes	1-10 Scale
There is a greater risk to responders for developing chronic or long-term health conditions from responding to disasters in austere conditions than that of their normal daily operations.	Mean: 6.22 Consensus Achieved?: Yes	1-10 Scale
Professional emergency responders operate safer in austere disaster conditions than they do in normal daily emergency situations?	Mean: 5.67 Consensus Achieved?: No	1-10 Scale
Trained volunteer responders tend to take on more risk when responding to a disaster in austere conditions than they normally would.	Mean: 7.67 Consensus Achieved?: Yes	1-10 Scale
Untrained spontaneous volunteers take more risk when responding to emergencies in a disaster in austere conditions than they normally would?	Mean: 9.56 Consensus Achieved?: Yes	1-10 Scale
There are there more real hazards and risks for responders when responding in a disaster austere condition versus daily operations?	Mean: 7.67 Consensus Achieved?: Yes	1-10 Scale

Survey Question List	Question Data	Question Type
Emergency responders typically perceive an increase in hazards and risks when working in austere conditions.	Mean: 8.56 Consensus Achieved?: No	1-10 Scale
To what extent does the sense of urgency of a disaster in austere conditions cause responders to accept more risk in their task?	Mean: 8 Consensus Achieved?: Yes	1-10 Scale
To what extent does limited resources in responding to a disaster in austere conditions cause a responder to accept more risk in the tasks?	Mean: 8.44 Consensus Achieved?: Yes	1-10 Scale
Would a centralized site for voluntarily tracking injuries to responders in austere and disaster situations be useful to the emergency service professions?	Mean: 8.22 Consensus Achieved?: Yes	1-10 Scale
Would a centralized mandatory reporting database for injuries and disaster in austere conditions to responders be beneficial to emergency service fields?	Mean: 8.22 Consensus Achieved?: Yes	1-10 Scale

The data in the table above shows that, for the majority of the statements listed, there was a consensus agreement. There was a general agreement that injuries in austere conditions need to be monitored in some form by the respondents, and that the proposed idea of a central database could be helpful. Although question 8 did not reach a consensus of agreement at the end of the final round, a consensus agreeing with the statement was formed in the first round, and the data collected showed a relatively high mean. The standard deviation for the first round of this

question was 0.9, and the mean was 9.1, showing that, during the first round, the respondents were all relatively assured that austere conditions increased the risks associated with being a first responder. The agreement that austere conditions and limited resources may encourage a responder to accept more risk is especially dangerous when paired with the increased risk that the conditions already impose. The career responders came to an agreement that even untrained volunteering responders are more likely to accept this elevated risk, leading to a greater chance of injury.

There was a level of disagreement that austere conditions encourage safer operations by responders. In fact, the other responses suggest that responders are riskier in these situations, while not taking into account additional safety precautions. While question 4 had a relatively low mean when compared to the other responses, there was no consensus reached, suggesting that safety precautions taken in austere conditions may vary from responder to responder. In addition, there was a relatively low level of agreement that austere conditions may increase the chances of developing chronic conditions. This likely also varies based upon the response. First responders working in polar conditions are less likely to develop or contract chronic illnesses than those working in environments with high amounts of airborne chemicals or particulates. In addition, the presence of personal protective equipment can have a large impact on the risks of chronic illness associated with these responses, as well as the level of experience.

Below is a list of the written response questions used in the Delphi Study and the responses given.



Table 4.1.1 *Survey Question Written Response Data*

Written Response Question	Responses Given
<p>What would be the Most important pieces of information to collect in such a database?</p>	<ul style="list-style-type: none"> <li>- Cause of the injury</li> <li>- Type of injury</li> <li>- Location and setting type of injury, illness Perceived cause Context surrounding the event, resources, education, leadership engagement, communications, amount of sleep/nutrition/stress before incident Support following incident, medical, worries comp Suggested future mitigation per team member opinion General past health status of employee: physical fitness, diagnoses, care needs etc.</li> <li>- Nature of illness, S/S, MOI</li> <li>- Direct injuries resulting from work, but also injuries form living circumstances. Same with illnesses. Would need to track illnesses for a few after the event as well. Food born, respiratory, etc.</li> <li>- Injury type, time of day, weather conditions, severity</li> </ul>
<p>What do you see as the most important hazards and risks to educate responders about for responding in austere disaster conditions for their safety?</p>	<ul style="list-style-type: none"> <li>- Generally. weare there for a reason.</li> <li>- Most emergency responders do not operate in austere conditions on a daily basis. So to work, and sometimes live, in an austere environment would add a whole new level of attention, planning, and acclimation.</li> <li>- Yes, the responder perceives the hazards, but the responder will take higher risk as the thought of being the only resource creates the need to do more.</li> </ul>

	<ul style="list-style-type: none"> <li>- The keyword is perception. Regardless of whether it's true that safety is more at risk, people mentally prepare for the unknown in a disaster deployment, and I think that leads to the perception of greater risk to their safety.</li> <li>- Perceptions vary based on experience and the amount of situational information available.</li> </ul>
<p>Are you aware of any organization or data sites that specifically tracks injuries to responders while working in austere or disaster conditions?</p>	<ul style="list-style-type: none"> <li>- No</li> <li>- No</li> <li>- No</li> <li>- Researcher scrubbed version of comment - Experienced injury example shows organization did not proactively protect workers in these situations to prevent or to correct injury</li> </ul>
<p>Do you have any other information or areas that you think are of major concern as we move forward studying responder safety in austere conditions?</p>	<ul style="list-style-type: none"> <li>- Responder safety in austere conditions requires the responder to acknowledge that failure to complete a task in an austere environment for safety reasons is acceptable within the context of response. But I do not think their moral compass will allow them to not take risk.</li> <li>- No, thank you.</li> <li>- I have been in situations where responders have been asked to wrap-up their teams operations and have pushed back at that. Some (most good ones) prefer to stay engaged when it was clear that their limits have been reached. At that point a safety officer is comprised and the Safety Officer ( or IC) needs to step in.</li> </ul>

When asked about developing a database for reporting line-of-duty injuries, the respondents agreed to several key elements, such as the nature of the injury, and the circumstances under which the injury was developed. Ideally, we could identify patterns based upon these factors, as well as the response taking place, the personal protective equipment being used, and the amount of prior experience the responder may have. The respondents displayed mixed opinions about the perception of hazards in austere conditions. Multiple responses noted that, as responding in austere conditions is not performed regularly, the level of experience from the responder would have an impact on their perceived risks, as well as the way they conduct themselves during the response. One of the respondents noted that they had personally experienced responders attempting to continue their operation despite clearly having reached the limits of their responding abilities. Such instances are, as noted by the response, more likely to be performed by experienced responders. They are also under personal moral pressure to continue the response despite safety concerns in doing so. In addition, the responders had no awareness of any organization collecting data on responders' injuries at an individual level, though the responders reached a consensus that one would be useful.

## Chapter V: Closing Discussion

### 5.1 Proposed Recommendations

Responding to disasters in austere conditions can introduce additional risks to first responders that lead to more frequent or severe injuries. Disasters that have required first responders to work in unusually inhospitable environments, such as the World Trade Center attacks, have been associated with increased injuries, deaths, or chronic conditions. In such instances, responders may be more likely to exert themselves beyond their limits and put themselves in at additional risks. Injuries obtained while responding to disasters are not adequately tracked, and this makes it more difficult to determine how we can improve safety in austere responses. The results of the Delphi Study suggest that first responders believe that there is a heightened risk for chronic illnesses, although this varies across responders and the

conditions of the response. A lack of resources can also encourage responders to take additional risks.

A database that collects information relating to line of duty injuries and the development of chronic conditions would be advantageous for multiple reasons. It would allow emergency management professionals to determine patterns in the conditions of austere responses, and how they lead to injuries. This could assist the training of volunteer responders, who may receive substantially less training for responses in austere conditions than career-responders. They may be more susceptible to overexertion during austere conditions, and may not maintain safety precautions that pertain to the environment they respond in. We can also utilize responders' accounts of their personal experiences, even if they did not receive injuries or chronic illnesses. Documenting actions or behaviors that they have determined to be unsafe, but common in the response effort can outline what needs to be done to improve responder safety in austere conditions.

## 5.2 Conclusion

Examples of response efforts in austere conditions reveal the complications that come during the response efforts, as well as the effects on responders after the events. The signs of physical trauma align the frequency of psychological trauma symptoms as well, and responders have higher mortality, and mental and physical chronic illness rates in their line of work as well as off duty than the average American. A Delphi Study survey of subject matter experts reveals that they are aware of increased risks in austere conditions, and that in austere conditions, responders may be more willing to put themselves at risk. Tracking injuries in such response efforts can assist research in responder safety, as patterns in the circumstances in which responders are injured can help us avoid putting them in unsafe situations.

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