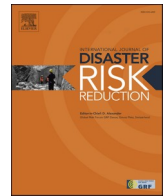




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## Responding to natural disasters vs. disease outbreaks: Do emergency medical service providers have different views?

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### ABSTRACT

**Introduction:** Our planet has been experiencing a huge burden of natural disasters and public health emergencies in the last three decades. Emergency medical service providers are expected to be in the frontlines during such emergencies. Yet, this system is badly understudied when it comes to its roles and performance during disasters and public health emergencies. This study is designed to enhance understanding by assessing a sample U.S EMS providers' views about working during natural disasters and disease outbreaks and explores whether they are coming to work during such conditions.

**Methods:** This study utilized a qualitative approach using face-to-face interviews with EMS workers from the State of Delaware, USA. Participants were asked about their views, insights, and potential behavior of working during natural disasters and disease outbreaks. Data collected were transcribed and coded using ATLAS.ti software to develop themes of the study using an inductive approach.

**Results:** Three themes were emerged from interviews regarding working during natural disasters; respondents expressed excitement, concern, or no real differences. For disease outbreaks, however, the two themes were concerned and no additional risk. While participants expressed varying concerns about working during disasters and pandemic conditions, everyone felt willing and obligated to come to work despite the perceived high risk for some of them to work in some conditions.

**Conclusion:** This study helps to provide the base upon which EMS, public health, and emergency management agencies can formulate actions that emerged from the views of EMS providers concerning work during disasters and public health emergencies.

### 1. Introduction

The number and intensity of natural disasters over the last three decades have been unprecedented for the last century. Our planet is experiencing about 500 natural disasters annually compared with 120 in the early 1980s [1]. Similarly, public health emergencies such as pandemic disasters pose a similar threat to our globe [2]. The Spanish flu pandemic of 1918-1919, for instance, infected one-third of the world's population and killed an astonishing 50 million people [2]. Since this pandemic, the deadliest in recorded history, several other disease outbreaks have swept through the world, including Severe Acute Respiratory Syndrome (SARS) in 2003, influenza A (H1N1) or the so-called swine flu in 2009, and the most recent Ebola in 2014. These events could easily overwhelm all components of the affected communities including

the healthcare systems.

During public health emergencies, healthcare providers are among those who make the first contact with affected victims, while providing services, despite the risk of infection or death to themselves. Research shows that, among those who became ill or lost their lives during the recent disease outbreaks, a disproportionate number were healthcare providers. For instance, 21% of SARS victims were healthcare workers, and some of them even transmitted the disease to their family members [3]. Additionally, healthcare workers are 21–32 times more likely to be infected with Ebola than people from the general population as shown in a recent report from the World Health Organization [4]. This could influence the intention of healthcare providers to work during such events [5].

Research on reporting for duty during disasters uses two methods.

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Studies that look for the potential reaction of the participants after receiving hypothetical situations are known as perception studies, whereas studies that look for the actual response of people during events are known as behavioral studies [6]. Although perception studies are based on hypothetical scenarios that might not replicate the real events and in turn may not predict the actual behavior, this method can be very useful as it has the potential to generate very large datasets. It can also be used to predict the attitude of people in less common events like terrorist attacks, pandemics, or public health emergencies [6].

Perception studies on reporting for duty show that, depending on the nature of the disaster, healthcare providers have shown different views toward intention to report to work and fulfill their job expectations. That is, healthcare workers are generally less willing to work during human-caused events and pandemic outbreaks than other disasters from natural events [1,7,8]. For instance, Connor (2014) found that 45%–58% of healthcare workers were willing to respond to a human-caused disaster such as a terrorist attack, 25%–82% were willing to respond to a pandemic, and 83%–90% were willing to respond to a mass casualty event such as a plane crash or a tornado.

Studies that explore the views of healthcare workers toward working during disasters and public health emergencies focus mainly on physicians, nurses and hospital administrators [9,10]. Little work has been done on emergency medical service (EMS) providers, despite the fact that they are an essential component of the larger healthcare system [9, 11]. EMS personnel are working in highly unstable environments relative to their counterparts at hospitals, and they are the ones who are likely to first contact patients with acute cases. They are at higher risk of injury and death than their “cousins” firefighters, and the national average for all occupations [12]. To further understand their potential behavior, this research examines EMS providers’ views about working during disease outbreaks and natural disasters.

## 2. Methods

This was a qualitative, semi-structured interview study. The aim of the study was to explore and understand the EMS providers’ views about reporting for duty during disease outbreaks and the factors that affect their feelings and potential attitudes. In order to accurately capture this kind of information, the use of a qualitative method was the appropriate choice [13]. The primary data collection method was face-to-face semi-structured interviews with frontline EMS providers. This method helps researchers to gain more information from the participants by capturing their words, insights, and expressions. While semi-structured interviews employ a number of predetermined questions, they also allow the researcher to probe far beyond the answers to get more in-depth information about particular areas of study [13]. An interview guide was developed and designed based on previous research on this topic to elicit the participants’ views about working during disease outbreaks, compared with both natural disasters and day-to-day operations. For the purpose of this study, *disease outbreak* is defined as “the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season” [14]. As defined by the World Health Organizations (WHO), *natural disasters* are “catastrophic events with atmospheric, geologic and hydrologic origins. They include earthquakes, volcanic eruptions, landslides, tsunamis, floods and drought” [15].

### 2.1. Sampling and data collection

EMS in Delaware is a tiered BLS and ALS service. BLS (basic life support) services are comprised of paid and volunteer EMS providers and are a fire-based service. ALS (advanced life support) services are paid and provided state-wide by the counties [16]. Both Emergency Medical Technicians (EMTs) and paramedics were included in the study sample. To obtain access to interview participants, the Office of EMS in the State of Delaware, USA, was contacted and agreed to facilitate

connections with appropriate interviewees for this study. To recruit interviewees, the primary researcher contacted the coordinators from different EMS stations asking them for site visit permission and logistics to perform the interviews with the on-duty EMS providers. A purposive sampling strategy, a method widely used in qualitative studies [13,17], was used to select interviewees for the study. Early participants were randomly selected from the accessible EMS stations to conduct one or two interviews at a time. Generally, three to four potential participants were available for interview if there is no active call. Later in the interview process, the primary researcher used a *criterion* purposive sampling strategy to recruit *information-rich* participants to fulfill different characteristics [17]. That is, the selection of interviewees included participants from different potential confounders such as job title, work status, gender, marital status, and years of experience as displayed in Table 1. Participants who agreed to take part in the study were asked to read and sign an informed consent about the potential risk of participation before starting the interview.

The first two interviews were conducted in May 2016, as pilot interviews. These two interviews were transcribed and discussed with research and EMS experts to assess the interview guide and participant responses. Interviews were conducted by the primary researcher and were audio-recorded. To ensure unbiased answers, the interviewer was not associated with oversight agencies or EMS employers. The interviews were conducted in the EMS stations with the on-duty EMS providers during their scheduled shifts. This was the most convenient time for participants given the fact that participants could be dispatched to a call at any time during the interview, which in fact had happened. The primary researcher was able to conduct the interviews in isolated spaces within the EMS stations with minimal disruptions and noises. Participants were selected from three different EMS agencies for EMTs and paramedics. This was done in coordination between the EMS agency and the primary researcher.

Once the information gained from the interviews reached the saturation state where more interviews started to add nothing new to the data and codes, the primary researcher conducted three more interviews to ensure that no new themes developed. This ended with a total of 22 interviews, and an average length of an hour for each interview. The Institutional Review Board (IRB) from the University of Delaware approved this study prior to the start of the interviews.

### 2.2. Data analysis

All interviews were audio-recorded and later transcribed. Along with the memos and notes, the transcribed interviews were entered into the ATLAS.ti (Scientific Software Development GmbH, Berlin, Germany) for analysis, coding, and theme development using an inductive approach. The analysis started with an open coding; a process by which all potentially useful and relevant data for answering the research questions were coded [18]. Given that the bulk of the interview questions were focused on comparing day-to-day operations, natural disasters, and disease outbreaks, one of the main coding methods used was versus coding [19]. Each code was labeled with a descriptive definition to keep track of the exact meaning of these codes. After coding transcripts in their entirety, the codes were refined to merge close or similar ones and to start the second cycle of coding. In the second cycle of coding, a thorough review of the quotations in each code was performed, and the

**Table 1**  
Interviewees’ demographics.

Job title	Work status <sup>a</sup>	Years of Experience	Gender	Marital status
EMT: 14	Full-time: 19	<5 year: 5	Male: 15	Single: 7
Paramedic: 8	Part-time: 10	5–10 years: 4	Female: 7	Married: 11
	Volunteer: 2	>10 years: 13		Divorced: 4

<sup>a</sup> Not mutually exclusive. Many of the interviewees work full-time in one agency and part-time or volunteer in another.

codes were classified into groups and categories where each category has relevant codes. Themes were developed from the views of participants within these categories along with the notes and memos [19].

To ensure the credibility and validity of the work, the researchers asked qualitative research experts as well as experts in pandemic management to review the proposal and the interview guide before conducting the study. This ensured that the content and the process of data analysis are appropriate and valid [13]. Additionally, to ensure the credibility and integrity of the analysis, after completing theme development, the researchers asked some of the participants about the themes and findings. Some of the participants mentioned that they are not surprised by these findings, which means that these themes are congruent with the participants' views. Moreover, this study included extensive reporting of the raw data in the form of quotations from the participants themselves, which allows the readers to assess the accuracy of data interpretation and establish credibility of the analysis.

### 3. Results

The primary researcher started the interviews by asking participants about their views regarding work during day-to-day operations. He then asked participants to compare that work with working during natural disasters and disease outbreaks. This question helped the researcher to understand the participants' views on how working during disasters and disease outbreaks differ from day-to-day operations. All participants viewed day-to-day operations as "another day of work" where they provide care for sick and injured patients. Their call volume could vary significantly. Their work shifts could be very slow or very busy, which depends on many factors such as the time of day, day of the week, season, location of the EMS unit, and average call volume in each particular unit. Their views to working during natural disasters and disease outbreaks are significantly different however.

#### 3.1. Natural disasters: "thrill seeking"

When participants were asked to express their views about working during natural disasters compared with their day-to-day operations, different views and insights emerged. This article describes three of the most common themes in their responses (Table 2). In the first theme, interestingly, participants considered responding to natural disasters the exciting part of their job.

**P4:** A huge disaster or terrorist threat can happen, it's the exciting [part] of the job ... it keeps me motivated because this is something that I have trained to do. This is ideally what I want to do.

**P4:** Kind of look like adrenaline junkies ... [EMS providers] like the excitement ... they want to be there, everybody wants to be there to get that thrill.

**P12:** Everybody in the EMS is pretty motivated. People who do this are motivated and they want to volunteer, they want to be part of whatever takes place, and get involved.

In the second theme, participants did not share the same enthusiasm about responding during natural disasters. Participants in this theme voiced concerns about their safety and the safety of their families. It is

**Table 2**  
Emergent themes for natural disasters and disease outbreaks.

Type of disaster	Emergent themes
Natural disaster	Excited and thrilled to work Concerned for self and family safety No real differences between working in everyday operations and working during natural disasters
Disease outbreaks	Concern due to lack of knowledge and the possibility of infecting others. The risk of working during disease outbreaks is the same as the risk of working in day-to-day operations.

the unknown-type situations and lack of experience that concerned providers. Most of these concerns are not, in fact, related to their job itself as EMS providers; rather, they are more concerned about family safety and transportation barriers and risks. However, these concerns would not keep them from performing their jobs.

**P14:** It is a stressful situation, so it is nerve-wracking, because if you do have an incident, then you have to make sure that we don't endanger ourselves trying to get to the place.

**P18:** In natural disasters, the first thing you're gonna figure out your family is okay, and then you're gonna do your job and make sure everybody else is okay. On a day-to-day, I know my family is safe.

In the third theme, participants noted that EMS providers found themselves in unsafe situations virtually on a daily basis. For instance, an EMS provider could be dispatched to a routine call and ends up in an active shooting scene. As such, they felt that there are no real differences between working in everyday operations and working during natural disasters.

**P5:** [Responding during] disaster isn't any different than anything else. It is just the number of people you have in the bad day.

**P11:** We work out in the field and anything can happen. Somebody could be crazy with a gun and shoot [while you are entering] the door. You can go into a fire, and a floor falls on it, and you die. Like, there is a risk with everything.

#### 3.2. Disease outbreaks: "A little more concerning"

When participants expressed their views and feelings to working during day-to-day operations and natural disasters, the interviewer asked them to compare that with the work during disease outbreaks, in terms of concerns, motivations, and barriers. Since the Ebola outbreak was still fresh in their minds, the interviewer used this outbreak as an example to explore their insights. Two themes emerged from their views and insights (Table 2). In the first theme, participants were more concerned about working during disease outbreaks when compared with normal conditions or natural disasters, which is due to lack of knowledge and the possibility of transporting the disease to others.

**P3:** [EMS providers] could potentially spread [disease] to innocents who are not involved in the situation ... So there is some anxiety that comes with that.

**P9:** Natural disasters ... we can't really prevent them, you know, they just happen, and you deal with it. Disease outbreak, I think a lot of people have a lot of fear, and it's a lot of uneducated fear ... People don't know about it as much, and the less educated they are, the more panicky.

**P1:** With an outbreak, if you don't completely understand what is causing it, how [a disease] is transferred, or what's even going on, then that's where the hesitation probably comes in with EMS people.

**P2:** In disease outbreaks, I think a lot of us are worried about taking it back home to the families.

In the second theme, participants did not see working during disease outbreaks as a concern. This group considered the risk of working during disease outbreaks the same as the risk of working in day-to-day operations. Participants highlighted that they are, sometimes, working with patients who have infectious diseases for which EMS providers have no vaccines, and still provide care for them.

**P5:** It is no different dealing with just a sick person today than it is dealing with someone during a disease outbreak.

**P8:** I will not say people are still excited to come, but when it comes to something like that, I mean EMS providers, we are going to [listen to] the warnings, and prepare with any type of protective equipment, gear, we need to carry, and that is all that we need to do about it.

**P17:** I know when I started this job, in the long run, I understand that every day I can get a thousand different diseases. So, one new disease isn't gonna scare me.

While participants expressed varying concerns about working during pandemic conditions, everyone from both themes felt willing and obligated to come to work despite the perceived high risk for some of them.



Yet, they were not “excited” to do this work, such as during natural disasters. Rather, they used less energetic statements:

**P3:** It is kind of your job to continue, even though there is an outbreak.

**P8:** This is what I chose to do, knowing the risks associated with it.

**P8:** I will not wake up in the morning excited to come to work.

The aforementioned views and insights were influenced by many factors. While EMS providers seem to be very dedicated and willing to come to work during disasters and disease outbreaks, there are many factors that may influence their decision to come to work. Some of the factors could potentiate their willingness while others may hinder. Family safety, confidence in employer, training and skills, and workplace culture are among the many factors that may influence the decision to come to work, which are not in the scope of this paper.

## 4. Discussion

### 4.1. Working during natural disasters

During disasters, not everybody would be willing to come to work to provide service in conditions that could be highly unstable and unexpected [1,7,8,20]. Health care workers could be reluctant to come to work if doing so could pose a threat to their health and safety of themselves or their family members [21]. The type of hazard is reported to be one of the major contributing factors on the willingness to come to work during disasters and public health emergencies [1]. A study performed by Ref. [22] Smith et al. (2011) assessed the risk perception of paramedics in Australia toward different kinds of hazards. The authors found that paramedics are familiar and have no fear of working in conditions of flood, cyclones, train derailments, and building fires or collapses. However, they found that paramedics are concerned the most from nuclear events, with the second most important concern being the outbreak of a new infectious disease.

The participants of our study shared the same views that they are willing and prepared to work during natural disasters. Most interestingly, working during natural disasters was viewed by many participants as the exciting part of their job as mentioned earlier. Curiously, the respondents' emphasis on excitement was not found in previous studies on healthcare providers. To understand this attitude, it is important to put it in a context. EMS providers receive a considerable amount of training on response to disasters using the Incident Command System (ICS). They are trained to provide search and rescue operations, triage, and emergency care depending on the type of disaster. However, when it comes to day-to-day operations, the majority of the EMS calls are non-emergency, or non-life threatening calls, meaning that patients need minimal care and transport to the appropriate care facilities [23]. To some extent, this type of work is routine and perhaps boring to providers. As mentioned by one of the participants, the majority of their calls “don't necessarily need all the training that we had,” because patients in these calls “just don't feel well”. However, during natural disasters, they like to help “the most amount of people in the most amount of danger.” Therefore, EMS providers prefer to provide care for acute cases of sick and injured victims, which is the kind of work that they enjoy and are trained to do.

Yet, few participants expressed concerns for self-safety and safety of family members during natural disasters. Most of these concerns are not related to their job itself as EMS providers. Rather, participants expressed concerns about family safety and transportation problems and risks. These concerns are in fact barriers to ability rather than to willingness to come to work. For instance, participants emphasized that transportation and other infrastructure issues that might occur during natural disasters could hinder their ability to come to work. That being said, if EMS providers are able to come to work, participants mentioned that they will show up as expected. This view is congruent with a study by Ref. [21] Smith et al. (2009) who found that even though EMS providers were concerned about working during natural disasters, they were adamant about fulfilling their professional responsibilities.

### 4.2. Working during disease outbreaks

Maintaining proper staffing levels during public health disasters is necessary to keep the system functional. The outbreak of SARS in 2003 resurfaced the dilemma of duty to care during disease outbreaks. Many healthcare workers were infected with SARS because of their work. Of those who contracted the infection, some transmitted it to their families, and two of them died [24].

Healthcare providers have different views and opinions toward working during disease outbreaks compared to natural disasters as shown in Connor study in 2014. When it comes to EMS [25], Tippett et al. (2010) found that 43.7% of EMS participants are unwilling to work during disease outbreak conditions. One-third of the participants indicated that they will refuse to work with a co-worker exposed to the infection. A study by Ref. [26] Barnett et al. (2010) showed more optimistic results though. They found that 93% of EMS personnel would be willing to report for duty if required, and 88% if asked, but not required. However, their willingness falls to 48% if there is a possibility of disease transmission to a family member. A previous and relatively similar study by Ref. [27] Mackler et al. (2007) found that 91% of the respondents would remain on duty if they have been vaccinated and guaranteed that they are protected from infection. This percentage, however, falls to 38% if their families have not received the vaccine. Only 4% probably would remain on duty if there is neither vaccine available, nor is there protective gear.

The current study contradicts the aforementioned studies on EMS about perception and potential attitude toward working during disease outbreaks. While participants did not show the same energy toward working in such situations as was the case in natural disasters, they were still willing to fulfill their work obligations. All interview participants believe that there are many risks associated with this line of work, and disease outbreaks could be one of them. They also believe that they are obligated to come to work as long as they have appropriate personal protective equipment (PPE) and training in place. It is interesting to know that none of the interview participants explicitly indicated that they would not come to work in outbreak conditions. This view contradicts [21] Smith et al. (2009), who found that paramedics were less willing to work in non-conventional disasters like pandemics. According to Ref. [21] Smith et al. (2009), the “unknown-type situation” and the “invisibility” of disease outbreaks are described as the main barriers to the willingness to work.

The 2014 Ebola outbreak helped in examining the preparedness of the EMS systems, but was not a real experience of disease outbreak in the United States. This outbreak devastated many areas in the West African region. In one of the outbreak documentaries [28], an EMS provider had separated himself from his family and children for five months to keep them safe from the infection, while he was doing his job. This is an example of how the dedication and commitment of EMS providers could be, and how difficult it also could be to make the decision whether or not to work in such situations. Therefore, we cannot definitively predict the behavior of EMS providers until such a crisis occurs.

This study provides stakeholders with the basics regarding the potential behavior of EMS providers. The findings of the study provide a motivation to the EMS organizations to consider measures that can better facilitate the safety and well-being of EMS providers. Although this system has not been tested at a large-scale disease outbreak for decades, it would be very beneficial to implement or coordinate the implementation of a large-scale drill or exercise where all stakeholders become involved. This helps in testing the current preparedness of the EMS systems and explores areas that may need improvements such as the level of EMS training and the ability of providers' families to function well during extended disaster responses. Doing so will ultimately benefit individual EMS providers, their agencies, and the communities they serve.

### 4.3. Limitations

Due to a lack of experience in real epidemics, it was difficult to assess views, feelings, and insights of the participants to work in such conditions. While the 2009 swine flu was a pandemic that affected almost every country in the world due to its ease of transmission, it was not virulent and in turn, did not scare healthcare providers including the EMS. The 2014 Ebola outbreak was very contagious and virulent and resulted in many illnesses and deaths. The outbreak impacted the West African region and resulted in many infections and deaths among healthcare providers. yet, in the U.S., where the study was conducted, Ebola consisted of less than 10 cases, only two of which were from local contagion. This is quite different from a potential outbreak of something like SARS or H5N1 (avian flu), which could affect hundreds of thousands of people or more. This would mean that all EMS providers would likely come in contact with victims of the disease, not just a dozen special cases. The broad epidemic, then, would present very different dynamics for EMS personnel, and in turn, may reveal different behaviors.

### 5. Conclusions

EMS systems need to be efficient when it comes to plan for, respond to, and recover from natural disasters or disease outbreaks. It is unthinkable what the consequences would be if EMS providers did not commit with their social and ethical responsibilities to do what is expected of them during crisis [29]. Research studies show that healthcare workers are generally—except for nuclear events—least willing to work during epidemics [30]. While it is difficult to draw a conclusion about the real behavior of EMS providers during disease outbreaks using perception studies [6], EMS providers in this sample are generally dedicated to their job, and willing to come and perform the duties that are expected of them. For natural disasters' response, they even showed excitement and thrill due to challenges and out-of-routine type work. For disease outbreak situations, while not as thrilled compared to natural disasters, they still showed a high willingness to come to work.

### Declaration of competing interest

The authors declare no conflict of interest.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijdr.2019.101440>.

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