ORIGINAL RESEARCH

Realities of Rural Emergency Medical Services Disaster Preparedness

Paul M. Furbee, MA;[1,2] Jeffery H. Coben, MD;[1,2] Sharon K. Smyth, BA;[1,2] William G. Manley, RN, CEN;[1,2,3] Daniel E. Summers, RN, BSN, CEN, EMT-P;[1] Nels D. Sanddal, MS, REMT-B;[6] Teri L. Sanddal, BS, REMT-B;[6] James C. Helmkamp, PhD;[1,2] Rodney L. Kimble, BA, EMT-P;[1] Ronald C. Althouse, PhD;[2,4] Aaron T. Kocsis, RN, MS[5]

1. West Virginia University, Robert C. Byrd Health Sciences Center, School of Medicine, Center for Rural Emergency Medicine, Morgantown, West Virginia USA
2. West Virginia University, Robert C. Byrd Health Sciences Center, School of Medicine, Injury Control Research Center, Morgantown, West Virginia USA
3. West Virginia University Hospital, Trauma Services, Morgantown, West Virginia USA
4. West Virginia University, Survey Research Center, Morgantown, West Virginia USA
5. West Virginia University Hospitals, Ruby Memorial, Morgantown, West Virginia USA
6. Critical Illness and Trauma Foundation, Bozeman, Montana USA

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Correspondence:
West Virginia University
Robert C. Byrd Health Sciences Center, School of Medicine
Injury Control Research Center
PO Box 9151
Morgantown, WV 26506-9151 USA
E-mail: pmfurbee@hsc.wvu.edu

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Abbreviations:
CIT = Critical Illness and Trauma Foundation
CST = civil support team
DMAT = disaster medical assistance team
EMS = emergency medical services
FEMA = (US) Federal Emergency Management Agency
HazMat = hazardous materials
SME = subject matter expert

Abstract

Introduction: Disaster preparedness is an area of major concern for the medical community that has been reinforced by recent world events. The emergency healthcare system must respond to all types of disasters, whether the incidents occur in urban or rural settings. Although the barriers and challenges are different in the rural setting, common areas of preparedness must be explored.

Problem: This study sought to answer several questions, including: (1) What are rural emergency medical services (EMS) organizations training for, compared to what they actually have seen during the last two years?; (2) What scale and types of events do they believe they are prepared to cope with?; and (3) What do they feel are priority areas for training and preparedness?

Methods: Data were gathered through a multi-region survey of 1,801 EMS organizations in the US to describe EMS response experiences during specific incidents as well as the frequency with which these events occur. Respondents were asked a number of questions about local priorities.

Results: A total of 768 completed surveys were returned (43%). Over the past few years, training for commonly occurring types of crises and emergencies has declined in favor of terrorism preparedness. Many rural EMS organizations reported that events with 10 or fewer victims would overload them. Low priority was placed on interacting with other non-EMS disaster response agencies, and high priority was placed on basic staff training and retention.

Conclusion: Maintaining viable, rural, emergency response capabilities and developing a community-wide response to natural or man-made events is crucial to mitigate long-term effects of disasters on a local healthcare system. The assessment of preparedness activities accomplished in this study will help to identify common themes to better prioritize preparedness activities and maximize the response capabilities of an EMS organization.

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Introduction

The 11 September 2001 attacks on the United States prompted large-scale efforts to improve the nation's emergency preparedness for terror incidents.[1–4] There exists a general consensus that US emergency healthcare systems are not prepared for large-scale terrorist attacks, and various recommendations exist for addressing these problems.[5–10] Emergency medical services (EMS) will be among the first medical responders to any mass-casualty event. The medical literature is replete with documentations of how unprepared EMS organizations are to deal with incidents involving weapons of mass destruction, and an equal number of remedies to address the problem have been pub-

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lished.[2,11–14] Emergency medical services organizations are not prepared for many of these threats, and the road to adequate levels of preparedness is long, difficult, and expensive.

Similarly, recent disasters, caused by natural hazards, such as Hurricane Katrina, have demonstrated the need to improve local, regional, and national preparedness for unintentional events. Other examples of preparedness challenges include earthquakes, tornadoes, floods, hazardous materials incidents, heat waves, and other events from natural hazards.[15–19]

Emergency medical services organizations have been told that they are not prepared, and that they need to become prepared. They also have been informed that if they do not have certain resources, they are not prepared. They have been offered a cornucopia of advice as to what they need to do to become prepared but are given little funding that would make this possible.[1,2,5,11,20,21] Some of this advice has been demonstrated as inappropriate for EMS agencies in rural areas.[22] While urban EMS systems often are involved in community emergency management plans, questions remain as to what preparedness means to the many small rural EMS organizations that serve some 75% of the nation and the nearly 49 million citizens who live in rural areas. It has become clear that the barriers and challenges to rural EMS differ significantly from those faced by their urban counterparts. These include: (1) smaller or non-existent public health departments; (2) less system-wide capacity; (3) little available resources; and (4) occasionally inferior communication technology. Also, they are handicapped by: (1) increased reliance on volunteers; (2) fewer healthcare professionals, particularly experts in mental health, infectious diseases, and burn treatment; (3) less surge capacity; (4) downsizing and hospital closures; and (5) greater distances from other needed resources.[23–27]

Currently, there is no single standard that requires EMS organizations to have a disaster plan,[28] and there is no guarantee that the existing plan (if there is one) is well-conceived, or that the personnel have been adequately trained for the implementation of the plan. The preparedness standards for EMS organizations also are not clear and provide no guarantees or assurances that the responses will be adequate.[29–33] Given the rarity of certain events, it is unknown whether the knowledge and skills obtained through education and training will be retained until the unfortunate opportunity to apply them arises. Does this mean that EMS organizations must train constantly for specific events that are unlikely to occur? Does it make sense for rural organizations that already are struggling to stay financially viable, let alone retain staff trained in basic life support?

Few studies have addressed the preparedness needs of rural EMS organizations in the US. The objectives of this study were to assess the attitudes and experiences of rural EMS organizations regarding emergency preparedness and responses to mass-casualty events. The experience and attitudes reported by these organizations should contribute to a discussion of the appropriate scale and context of preparedness in rural settings in the US.

Methods

A mailed, written survey was administered to rural EMS agencies in the US Federal Emergency Management Agency (FEMA) Region 3 and FEMA Region 8, plus four other Western states in the US suggested by the Critical Illness and Trauma (CIT) Foundation of Bozeman, Montana. Address lists for all EMS agencies within these regions were obtained from state EMS Directors and the CIT's regional alliance. These addresses were classified as "rural" or "not rural", depending on whether the entire county or just certain ZIP codes were classified as rural according to the US Department of Agriculture guidelines by matching the ZIP codes to counties.[34] Only agencies in rural ZIP codes were included within the sample. A total of 1,815 EMS agencies were included in the final sample.

Survey Instrument

A team of subject matter experts (SMEs) developed an evidence-based domain matrix to generate a large pool of questions. The final domains of inquiry included: (1) agency self-assessment of preparedness for various types of disasters or mass-casualty incidents; (2) actual experience with and participation in disaster response including the frequency, type of event, and impact on the organization; (3) priorities and beliefs on the expenditure of time and money on disaster training; and (4) actual training activities completed by the organization both before and after the 11 September 2001 terrorist attacks. To probe the agency's self-assessment of preparedness, a number of scenarios were presented that included both natural and man-made mass-casualty events. Respondents were asked to rate their level of preparedness for these events on a semantic differential scale of 1 (very prepared) to 5 (very unprepared). Finally, a brief set of questions was asked to gather descriptive organizational characteristics. The instrument was pilot-tested with experienced EMS personnel and an expedited West Virginia University Institutional Review Board application for the survey was approved.

The survey was mailed to all EMS agencies in the sample and addressed to the organization's Training Officer. A cover letter and a terminology page to explain terms or acronyms that the SME team thought might be unfamiliar accompanied each survey. Data were collected over a three-month period.

Results

The final response rate for the survey was 43% (768/1,801), with only 14 addresses determined to be undeliverable. Since there was no demographic information other than the organization's name and address, it was impossible to determine whether there were any differences between organizations that returned surveys and those that did not.

Surge Capacity

When asked about the estimated number of critically ill or injured patients being treated simultaneously that would overwhelm their resources, 70% of respondents reported that it would only take five or fewer patients to overwhelm

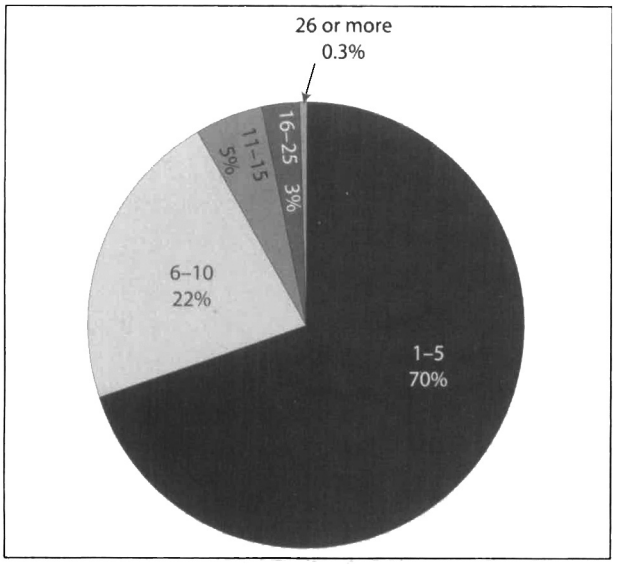

Figure 1—Number of patients that would overwhelm emergency medical services organizations

them (Figure 1). An additional 22% of respondents said they only could handle 6–10 patients without overwhelming their capacity. Only 3% of all respondents felt capable of handling up to 25 patients simultaneously.

Perceived Response Capabilities

Organizations also were asked to rank how well-trained and equipped personnel were to deal with a number of different emergencies. Figure 2 shows the relative percentages of EMS organizations which ranked their preparedness as either very prepared or very unprepared. Emergency medical services organizations felt confident in dealing with cardiac emergencies and motor vehicle trauma. They felt less prepared for victims of chemical weapon attacks and bombings, and to a lesser degree, infectious disease outbreaks. They felt better prepared to deal with hazardous materials (HazMat) incidents than they did chemical weapon attacks.

Similarly, organizations were asked how prepared they were to deal with various events involving different numbers of victims. In this list of scenarios, EMS organizations felt most prepared to handle two elderly patients diagnosed with influenza and a single patient who had been diagnosed with chickenpox. They were more confident that they were prepared for one patient who has died of smallpox than they are for either a factory explosion that has killed several and injured 24 or a HazMat incident involving a tanker spill and 12 patients needing transport. In general, incidents involving a greater number of victims inspired less confidence in their preparedness.

Respondents were less confident in their level of preparedness for a terrorist bombing than they were an explosion at a factory and similarly, they were less confident in their level of preparedness for a chemical weapon attack versus a HazMat spill, even though the known casualties were similar and the actual agents involved were unnamed in each incident.

Actual EMS Experience

A total of 293 EMS organizations (38%) indicated that a mass-casualty incident had overwhelmed them during the past two years. Only 186 organizations (24%) said that their disaster plan had been exercised during the past two years. Two hundred (26%) assisted with the responses to a state-declared disaster, only 27 (4%) ever had worked with a Disaster Medical Assistance Team (DMAT), and only 25 (3%) had worked with a Civil Support Team (CST). However, 65 (8%) had worked with a Community Emergency Response Team (CERT) in a disaster response within the past two years.

Training Activities

The greatest emphasis in training was in the concept areas associated with structural collapse and terrorism. These content areas each increased >220%. This indicates that more terrorism training exercises were conducted during this timeframe than there had been actual events (Figure 3). Other areas of increased emphasis included training to respond to infectious disease outbreaks, explosions, riots, earthquakes, and bombings. All other training areas were de-emphasized during this period, with training for structural fires decreasing 74%. Since 11 September 2001, there has been a decline in the emphasis on training for severe weather incidents of all types (Table 1).

Training Priorities

Training officers were asked to rank their top five priorities, considering the realties of operating their organization, in the areas which needed the most improvement. The number of organizations that chose not to rank an issue is compared with the number of organizations that did not rank the issue in their top five in Figure 4. The most frequently chosen issue was their "ability to attract and retain personnel," followed by "preparedness to respond to common multiple casualty events," and "ability to communicate with other responders during an emergency." The areas of improvement that were considered least important were: "ability to recognize when they have been exposed to radiological contamination," and; "interaction and relationship with local health departments."

Respondents also were asked, "If you were awarded a $100,000 grant to spend on training current personnel limited to the following areas, which would be your top five priorities?" For the sake of clarity, all responses were collapsed into either high priority (ranked 1-5) or low priority (not ranked at all). Data are presented in Figure 4. Respondents gave the highest priority to training for general disasters, advanced life support, the incident command system, scene safety, and triage. These priorities refelct an empasis on all-hazards types of training rather than specialized training related to terrorism and weapons of terrorism.

Discussion

The results of this study reflect the realities of rural EMS organizations. In general, these organizations have limited resources and surge capacities. Their ability to respond adequately to mass-casualty events involving dozens of patients is questionable, and that they do not have the ability to respond effectively to large-scale disasters or the

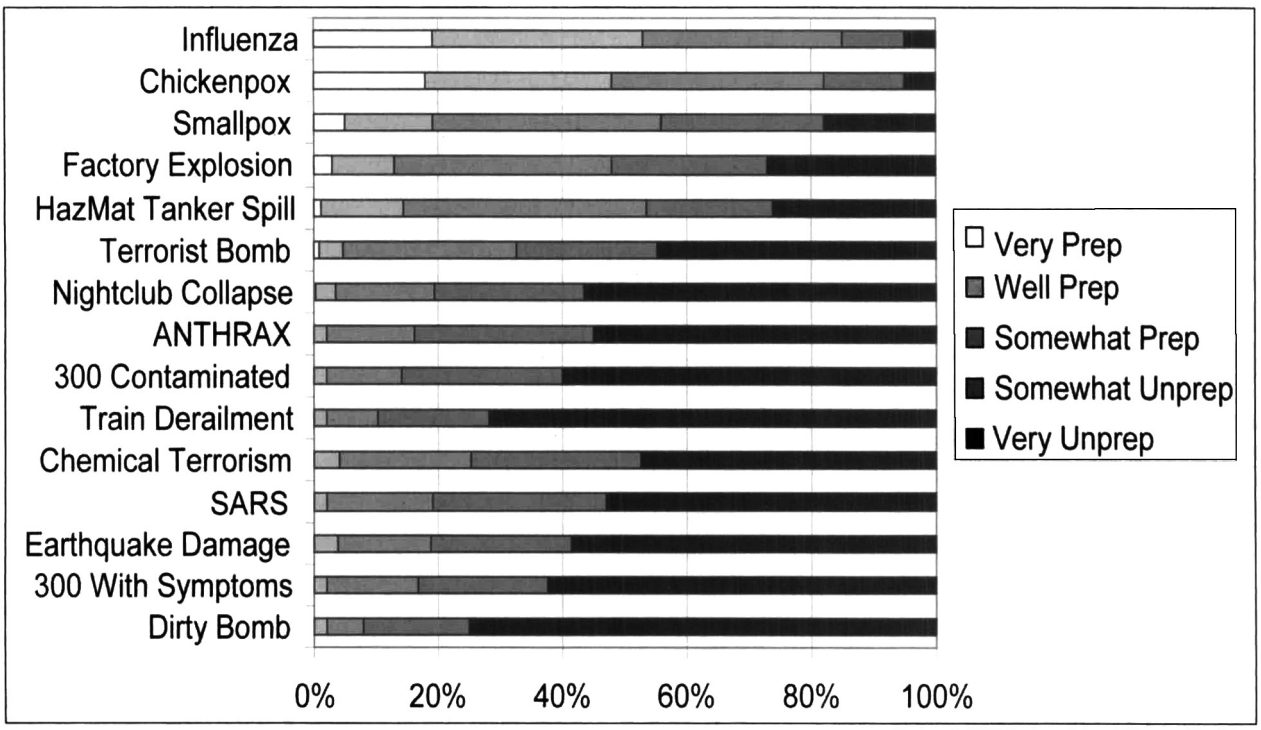

Figure 2—How well prepared emergency medical services systems are to handle different events (HazMat = hazardous materials; Prep = prepared; SARS = severe acute respiratory syndrome; Unprep = unprepared)

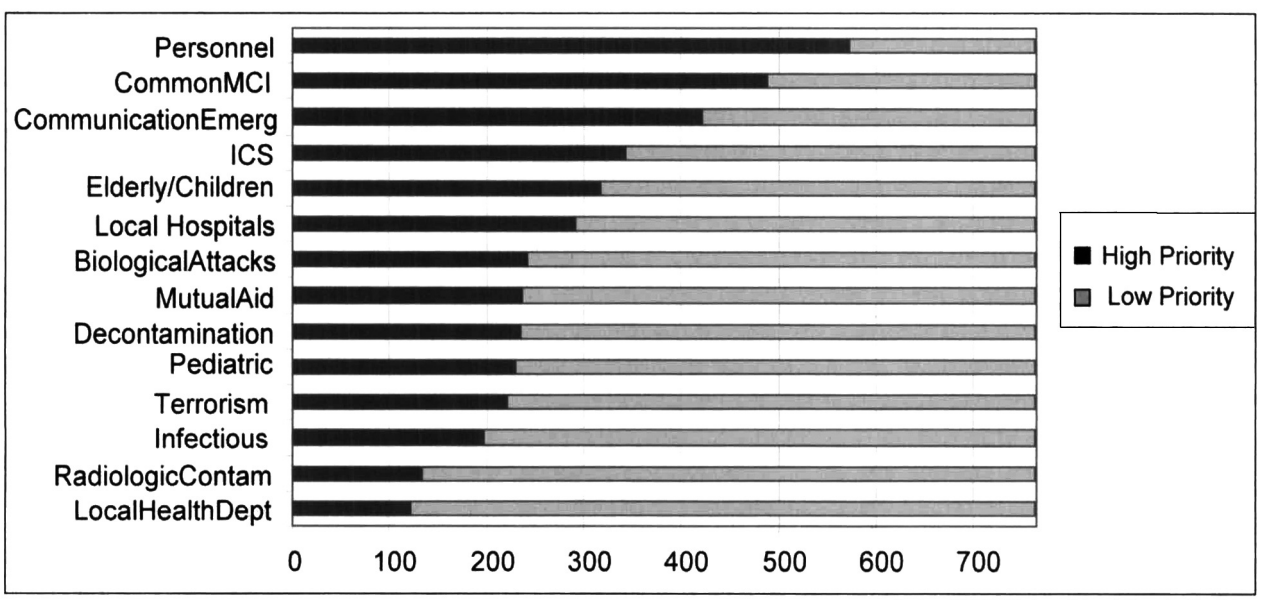

Figure 3—Emergency medical services improvement priorities (ICS = incident command system; MCI = mass-casualty incident)

migration of large populations displaced from urban areas. Most importantly, there is a serious disconnect between the actual experiences of rural EMS organizations and the training/preparations being performed by these organizations.

When an urban infrastructure collapses, such as occurred in association with Hurricane Katrina, displaced people overwhelm neighboring communities. While much of the attention immediately following the event is focused on the needs of people at ground-zero, significant impacts on the surrounding area occur that may receive little attention. Preparedness and surge capacity [conditional needs] are regional issues. Natural disasters still will occur, despite terrorist threats occupying so much of the nation's preparedness focus. In fact, disasters caused by natural events statistically are more likely to occur. In the case of the recent disaster in the wake of Katrina, known threats had been identified years before, yet preparedness was inadequate.[35,36]

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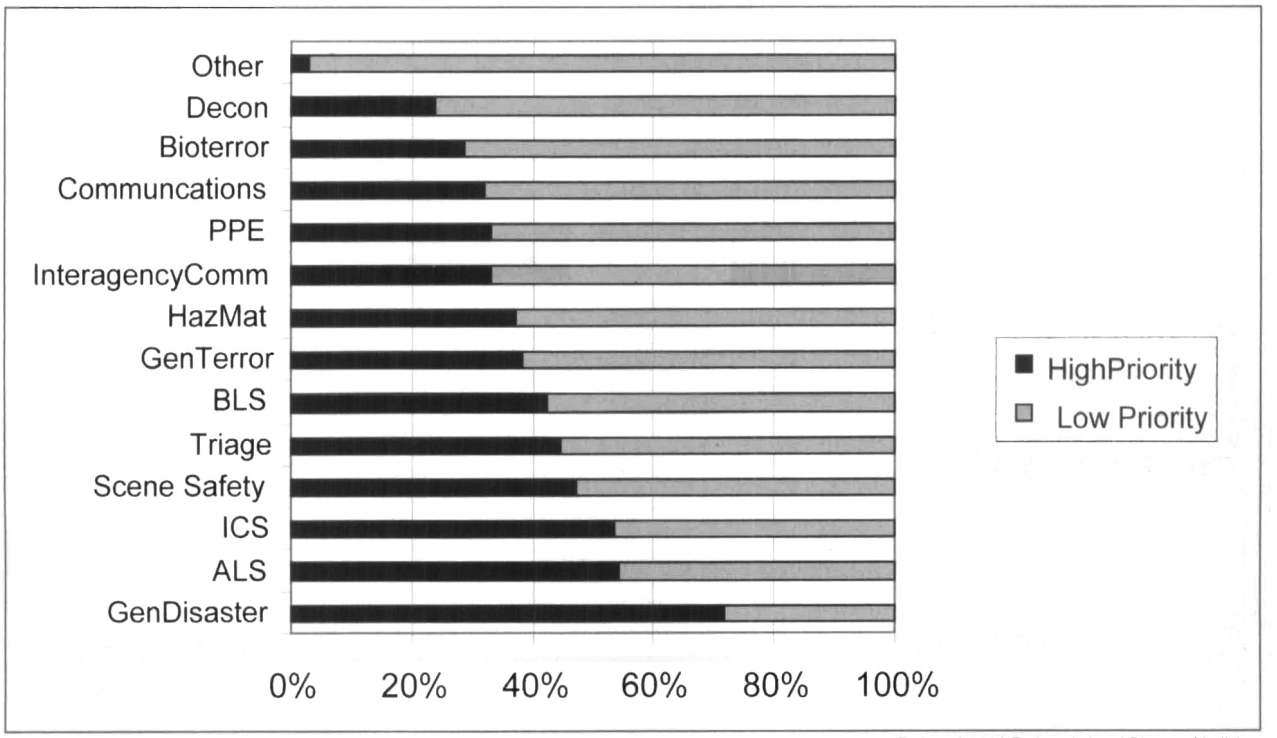

Figure 4—Training priorities of emergency medical systems organizations (ALS = advanced life support; BLS = basic life support; comm = communication; Gen = general; ICS = incident command system; PPE = personal protective equipment)

Respondents to this survey reported a large increase in training for terrorism-related scenarios. They also reported a decline in the amount of training dedicated to weather emergencies and other common events. The scenarios presented in many of the drills and exercises related to terrorism often involve large numbers of victims; numbers that are well in excess of what many rural EMS organizations could deal with effectively.[37,38]

The rural EMS organizations responding to this survey reported little experience with widespread, state-declared disasters. They also reported minimal experience working with state and federal authorities. Further, the organizations appear to underestimate their need to work with local health departments or improve interagency communication. These findings are causes for concern. With limited capabilities to manage even relatively small, mass-casualty events, rural EMS agencies are struggling to become more knowledgeable and proficient in the management of these scenarios. Given the relative paucity of terrorist events, it is unlikely that specialized skills and knowledge will be retained until there is an opportunity to use them. This problem is exacerbated for rural EMS organizations that are struggling with high staff turnover and personnel shortages. It does not make sense to provide staff with advanced terrorism training if skills are lagging in basic and advanced life support and trauma care. This is underlined further by the finding that EMS organizations are most concerned about their ability to attract and retain personnel. Common sense would suggest that if EMS cannot respond to day-to-day events, there is no way they can respond effectively to large-scale events. The best way to ensure an effective response to a large-scale event is to concentrate on improving the efficiency and effectiveness of day-to-day operations.

Given the challenges confronting rural EMS agencies, emergency preparedness activities directed towards these organizations should be focused on: (1) maintaining an all-hazards approach to disaster recognition, containment, and response; (2) improving inter-agency communication skills and capabilities; and (3) increasing involvement in regional planning and developing a clear understanding of the roles and responsibilities of local EMS along with other local, state, and federal agencies. The latter recommendation is important, particularly given the fact that their limited resources will require immediate access to regional assets.

Limitations

The study has several limitations. While the survey was addressed to the organization's training officer, it is unknown who actually responded because demographic data were not collected. Therefore, some of the answers could be skewed based on the respondent's responsibilities or background of the respondent. Secondly, the survey was a self-reported instrument, and validation of responses was not conducted. Thirdly, the respondents could have been involved in organizational management, and probably would not have answered in a way that was detrimental to their organization or personal responsibility. Therefore, the methodology may not have represented accurately the actual training that was completed or the actual events that had occurred.

	Actual responses	Pre-11 September 2001 Training Exercises	Post-11 September 2001 Training Exercises	Percent Change Pre- to Post- 11 September 2001
Earthquake	0	8	12	50
Avalanche	1	12	9	25
Terrorism	1	42	136	223
Riot	2	5	8	60
Infectious Outbreak	5	40	90	125
Structure Collapse	10	71	233	228
Bomb	12	70	77	10
Train Derailment	12	45	33	26
Explosion	16	86	90	104
Other Natural	18	11	6	45
Heatwave	20	18	9	50
Airplane Crash	24	183	143	23
Lightning	25	29	12	59
Multiple GSW	35	66	49	26
Tornado/Hurricane	45	50	46	8
Power Failure	47	42	28	33
Other	57	32	25	22
Flood	108	91	80	10
Bus	108	272	182	33
Hazmat	116	324	342	6
Severe Weather	157	129	111	14
Structure Fire	208	264	71	73
Multiple Vehicle MVC	450	421	364	14

Table 1—Disaster response and pre- vs. post-11 September 2001 training exercises (GSW = gunshot wounds; MVC = motor vehicle crash)

Conclusion

The results of this study provide insight into current training domains for rural EMS personnel. Development of reasonable preparedness benchmarks for these organizations is valuable for key management personnel and state-level regulators who are struggling to deal with the challenges, emergencies, mass-casualty incidents and disasters that are encountered on a daily basis. Organizations must have a way to assess their current level of preparedness and to know exactly what they must do to improve. They also must be aware of what they actually are prepared to do after such changes have been implemented. Rural EMS personnel must discover how to maintain adequate and sustainable training levels. They cannot afford to prepare for worst-case scenarios that are defined in urban terms. To be sustainable and cost-effective, rural EMS organizations may need to train for the commonalities of all hazards instead of the specific threats of rare and exotic events and agents. Common elements of all disaster scenarios include: (1) communications; (2) command and control; and (3) interagency cooperation. Exercises concentrating in these training areas are more likely to result in a sustainable preparedness that is dual-purpose and all-hazards oriented.

Healthcare communities, including prehospital, hospital, and public health care also must develop new approaches to address surge capacity. Simulation models, such as those found in Systems Dynamics, are an option that may prove useful to organizations in readying themselves to confront not only catastrophic mass-casualty incidents, but also the most frequent events that can overwhelm their communities.[39] These types of simulations can identify, in a cost-effective manner, a number of bottlenecks that restrict surge capacity, which otherwise might not be considered.[40] Healthcare policy-makers must assess regional surge capacity needs in public health emergencies and develop best practices for rural healthcare preparedness.[41]

Rural EMS organizations cannot be expected to handle large-scale events in isolation. This survey suggests that EMS are training significantly for large-scale terrorist events, even though they have only limited surge capacity.

Despite this, EMS organizations infrequently are involved in large, system-level, preparedness activities. Furthermore, they have limited involvement with local health departments and various federal response entities, such as DMATs, and CSTs for interagency preparedness or response activities. Training exercises, whether tabletop, simulations, or drills, must include interactions with the entire response community.

In order for the rural US to be best prepared for disasters of all types, the main focus must shift away from individual organizations and move towards active participation in a community-wide and region-wide response that includes entities such as hospitals, public health, other EMS organizations, community practitioners, and local, state, and federal response personnel. It is important to study EMS in other countries to determine if these findings can be applied more generally.

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THE WORLD ASSOCIATION FOR DISASTER AND EMERGENCY MEDICINE

Requests Input and Expressions of Interest in the Development of Regional Chapters

The World Association for Disaster and Emergency Medicine (WADEM) is an international, humanitarian association dedicated to the improvement of disaster and emergency medicine. Its Board of Directors, pursuant to decisions of the Board made at Edinburgh, Scotland, May, 2005, hereby offer the designation of WADEM Chapters to nation-states, nation-state provinces, or individual states, regional organizations and recognized healthcare societies of these entities who share the mission and dedication of WADEM.

Chapters will have an academic, research, and/or operational focus and will participate as a recognized chapter to further develop for the WADEM and the individual chapter membership:

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- Interpretation and exchange of information through its network of members and publications
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- Coordination of data collection and provision of direction in the development of standardized disaster assessment and research and evaluation methodologies
- Encourage publications and presentation of evidence-based research findings in scientific publications, national, regional, and international conferences, and congresses
- Will foster and deliberately promote, whenever possible, the recognition of a regional, national, and or profession-specific knowlege base for the general WADEM membership. The WADEM agrees to recognize these advances in publications, conferences, congresses, task forces, and committees.

Interested in developing a Regional Chapter?
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