

Public Health Preparedness for Mass-Casualty Events: A 2002 State-by-State Assessment

N. Clay Mann, PhD, MS;¹ Ellen MacKenzie, PhD;² Cheryl Anderson, USPHS, RN, MPH³

1. Intermountain Injury Control Research Center University of Utah School of Medicine, Salt Lake City, Utah USA
2. Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland USA
3. Trauma-EMS Systems Program, Health Resources and Services Administration, US Department of Health and Human Services, Rockville, Maryland USA

Correspondence:

N. Clay Mann, PhD, MS
Intermountain Injury Control Research Center
615 Arapeen Drive, Suite 202
Salt Lake City, UT 84108-1284 USA
E-mail: clay.mann@hsc.utah.edu

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Abbreviations:

EMS = emergency medical services
HRSA = Health Resources and Service Administration
MMRS = Metropolitan Medical Response System
NACCHO = National Association of County and City Health Officials

Abstract

Introduction: The ongoing threat of a terrorist attack places public agencies under increasing pressure to ensure readiness in the event of a disaster. Yet, little published information exists regarding the current state of readiness, which would allow local and regional organizations to develop disaster preparedness plans that would function seamlessly across service areas. The objective of this study is to characterize state-level disaster readiness soon after September 2001 and correlate readiness with existing programs providing an organized response to medical emergencies.

Methods: During the first quarter of 2002, a cross-sectional survey assessing five components of disaster readiness was administered in all 50 states. The five components of disaster readiness included: (1) statewide disaster planning; (2) coordination; (3) training; (4) resource capacity; and (5) preparedness for biological/chemical terrorism.

Results: Most states reported the presence of a statewide disaster plan (94%), but few are tested by activation (48%), and still fewer contain a bioterrorism component (38%). All states have designated disaster operations centers (100%), but few states have an operating communications system linking health and medical resources (36%). Approximately half of states offer disaster training to medical professionals; about 10% of states require the training. Between 22–48% of states have various contingency plans to treat victims when service capacity is exceeded. Biochemical protective equipment for health professionals is lacking in all but one state, and only 10% of states indicate that all hospitals have decontamination capabilities. States with a functioning statewide trauma system were significantly more likely to possess key attributes of a functioning disaster readiness plan. **Conclusion:** These findings suggest that disaster plans are prevalent among states. However, key programs and policies were noticeably absent. Communication systems remain fragmented and adequate training programs and protective equipment for health personnel are markedly lacking. Statewide trauma systems may provide a framework upon which to build future medical disaster readiness capacity.

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Introduction

The recent and ongoing threat of a terrorist attack has resulted in state and local governmental agencies re-evaluating their capacity to adequately respond to these and other public health emergencies. While the probability of a terrorist attack (whether conventional, biological, chemical, or radiological) in any given locale remains difficult

to estimate,¹ it is clear that public agencies are under increasing pressure to ensure readiness in the event of such a disaster.²

Currently, emergency medical services (EMS) agencies, hospitals, and other components of the healthcare system are looking to state agencies for direction regarding the development and implementation of preparedness plans. While professional organizations and special interest groups provide helpful templates for the development of such plans,^{3,4} local providers look to governmental agencies to ensure that their efforts integrate into a comprehensive plan that would, in theory, function seamlessly across service areas in the event of a disaster.^{5,6}

Prior to 1990, few city, county, or state agencies devoted significant resources to developing comprehensive and integrated terrorism preparedness plans. Federal initiatives, such as the Nunn-Lugar-Domenici legislation⁷ and the Bioterrorism Preparedness and Response Program⁸ represent pre-11 September efforts to infuse states with the resources necessary to manage the task of integrating independent and diffuse programs into operational plans that would harness the expertise that exists within states. Nevertheless, the published literature suggests that state-level preparedness for natural or man-made disasters remained deficient prior to the 11 September terrorist attacks^{9–11} and may vary greatly from state to state.

The purpose of this report is to provide a cross-sectional “snapshot” view of individual state disaster readiness soon after the events of September 2001. It is hoped that providing such a glimpse at state-level disaster preparedness will provide insights regarding deficiencies that could be ameliorated by the increased federal funding currently available to states. Such data can be used as a “benchmark”, tracking state-specific progress in disaster readiness, and may facilitate networking among states to increase the probability of regionally integrated disaster plans. Secondarily, we conducted a correlative analysis to determine if the status of disaster readiness among states is associated with previously funded efforts to bolster a state’s response to emergency medical situations.

Methods

Study Design

In fiscal year 2001, the Trauma-EMS Systems Program, within the Health Resources and Services Administration (HRSA), utilized Public Health Service Act (Title XII) funds to develop and implement a standardized trauma needs assessment to be completed by all states and territories. Using a competitive grant mechanism, all 50 states were awarded funds to complete the survey. After the terrorist attacks of 11 September 2001, a state disaster preparedness component was appended to the survey. The final version of the survey was approved for dissemination by the Office of Management and Budget in January 2002. The survey was made available to states immediately, with the request that survey responses be provided by March 2002. This report includes summary information drawn from the disaster preparedness component of the survey.

Sample Characteristics

States were required to identify and convene a panel of stakeholders from within the state to complete the survey questions. The stakeholder group was to include representatives from many professional groups including: EMS administrators, hospital administrators, trauma nurses and surgeons, rural health officials, public health officials and citizen advocates. A primary contact person from each state was identified to respond to questions regarding the completeness and accuracy of the resulting survey data. This research was approved by the University of Utah School of Medicine Institutional Review Board.

Measurements

Shortly after the events of 11 September 2001, a panel of experts was convened by HRSA to develop survey items designed to estimate the current readiness of states to meet the challenges associated with a mass casualty event. Survey items were designed to characterize: (1) the content of statewide disaster plans; (2) specific attributes of disaster coordination and communication plans; (3) current requirements for disaster training; (4) availability of resources to respond to a biological or chemical event; and (5) the capacity of the overall system in the event of mass casualties. Items queried whether statewide coverage was available for each attribute of readiness (i.e., yes or no), if no, respondents were asked to estimate the proportion of the state population covered by existing programs related to the attribute of readiness.

An overall disaster readiness score was calculated for each state by summing percentage points for readiness attributes with statewide coverage (e.g., 100%) and partial state coverage (e.g., 80%) across all 27 survey questions. The resulting score was “unitless” and weighted each survey question equally. This readiness score was correlated with the number of funded Metropolitan Medical Response System (MMRS) programs conducted in each state, a measure of the elapsed time since implementation of MMRS projects in each state, and a three-point scale assessing the maturity of trauma systems in each state. Trauma system maturity was categorized as: (1) states with no authority to designate trauma centers [$n = 15$]; (2) states satisfying 3 to 6 criteria defined by West *et al*¹² [$n = 27$]; and (3) states meeting 7 to 8 West criteria [$n = 8$]. The West criteria rank states based upon enabling statutes or regulations granting state-level organizations the legal authority to develop, organize, and enforce trauma system policies aimed at ensuring trauma patients receive appropriate care in a timely fashion (Table 1).

Analysis

The analysis compares the status of state disaster readiness with previously funded efforts to organize a state-level response to emergency medical situations. Specifically, the maturity of state-level trauma systems and the implementation of MMRS programs within states were compared with overall state disaster readiness using nonparametric measures (e.g., Kruskal-Wallis test and Spearman *r*_{ho}). In

brief, the primary aim of the MMRS program is to develop or enhance existing emergency preparedness systems to effectively manage a weapons of mass destruction incident.⁸ In regards to trauma system maturity, the status of trauma system development in each state was assessed using criteria developed by West *et al*¹² as described above. All analyses were conducted using SPSS, version 11.5 (SPSS Inc., Chicago, IL).

Results

Survey Responses

Table 2 lists the questions addressed by stakeholder groups in each state. All 50 states hosted a stakeholder meeting and provided survey responses by June 2002. The resulting data were tabulated and presented to State EMS Directors and other local public health officials during various professional conferences from June to October 2002 to verify data accuracy. Specific time was allotted in each conference to review responses.

Disaster Planning

As of the first quarter of 2002, 47 states had written statewide disaster plans that address both a health and medical response (Table 3). The remaining three states had regional or local plans that apply to between 50% and 85% of the state population. Of the statewide disaster plans, 66% had been tested with activation of the health and medical system components on a statewide, regional, or local level. Actual mock disaster drills, including the health and medical components of the plan, had been conducted on a statewide basis in 58% of states. An additional five states had conducted mock disaster drills that include, on average, 60% of available health and medical facilities (range 30% to 85%). At the time of survey completion, 38% of statewide disaster plans included a bioterrorism component. An additional 15 states had regional or local disaster plans that addressed bioterrorism. A total of 19 statewide disaster plans addressed issues related to the contamination of livestock, crops, or animal feed.

Disaster Coordination and Communication

All states indicated that a state operations center is designated with responsibility in the event of a natural or man-made calamity (Table 4). In 33 states, a formal statewide mechanism existed to cooperatively develop and apply protocols for multiple-casualty incidents. An additional five states had such protocols in existence that covered 50% to 85% of the state population. Nineteen states had contingency plans to deal with possible manpower shortages among physicians, nurses, pharmacists, and other healthcare professionals. Six additional states had contingency plans for healthcare shortages that cover 6% to 70% (mean proportion = 40%) of the states' population. There are 18 states with a secure and continuously operating communications system, separate from the public telecommunications system, that linked health and medical resources in the state. An additional eight states had a similar communication system that would serve, on average, 54% of the state population (range 20% to 95%). In regards to

disaster surveillance, 80% and 58% of states reported participation in the Centers for Disease and Control (CDC) disease/disaster surveillance system and a state-based system, respectively.

Disaster Training

In regards to specific training for hospital professionals, Table 5 indicates that 28, 27, and 23 states offered training in the areas of disaster management, biological terrorism, and chemical terrorism, respectively. An additional nine states offered training in these areas to, on average, 39% of appropriate hospital personnel (range 6% to 80%). The number of participating states drops dramatically when identifying states that require statewide training for hospital professionals in the areas of disaster management ($n = 8$), biological terrorism ($n = 2$) and chemical terrorism ($n = 2$). Only two, four, and five additional states had local mandates that required similar training to a proportion (between 4% and 40%) of appropriate hospital personnel in the three above stated areas of disaster training.

When considering the training of EMS personnel, 32, 27, and 28 states offered training in the areas of disaster management, biological terrorism, and chemical terrorism, respectively. An additional seven states offered training in the above mentioned three areas of disaster training to between 10% and 95% of appropriate EMS personnel (mean proportion = 47%).

Similar to the findings for hospital personnel, numbers decrease when investigating the number of states that require statewide training in the areas of disaster management ($n = 6$), biological terrorism ($n = 1$), and chemical terrorism ($n = 3$). Four additional states required similar training to a proportion (between 10% and 40%) of appropriate EMS personnel in the three above stated areas of disaster training.

Preparedness for Biological or Chemical Terrorism

Only one state reported that adequate personal protective equipment would be immediately available, on a statewide basis, for EMS personnel in the event of a biological or chemical event (Table 6). Twenty-five additional states indicated that <50% of EMS personnel would have access to the needed personal protective equipment. One state indicated that adequate personal protective equipment would be immediately available (statewide) to hospital personnel in the event of a biological event, but not a chemical event. Twenty-three additional states reported adequate protective equipment available statewide for, on average, 20% of appropriate hospital personnel in the case of a biological or chemical event (range 1% to 70%).

Eight states indicated the presence of resources statewide to ensure that other patients and healthcare providers, in the hospital setting, are not endangered when treating victims of biological or chemical terrorism in local facilities. When considering the out-of-hospital setting, the same eight states reported that the necessary resources would be available to ensure that other patients and EMS personnel would not be endangered. Some additional states reported available resources to protect some proportion of in-hospital personnel (between 1% and 70% [mean = 23%,

1. Does your state have legal authority to designate hospitals as trauma centers?
2. Does your state have a formal process for designating hospitals as trauma centers?
3. Does your state use the American College of Surgeons' standards for classification or categorization of trauma centers?
4. Do you use on-site hospital visits to determine a hospital's initial compliance with trauma center standards?
5. Is the number of designated trauma centers limited based upon patient volume, community need, or population of the area?
6. Are triage criteria in writing and do they form the basis for bypassing non-designated hospitals and sending patients to trauma centers?
7. Are there evaluation activities in place to monitor trauma system outcomes and processes on an on-going basis?
8. Are designated trauma centers strategically located to provide state-wide coverage?

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Table 1—Criteria for assessing trauma system development as described by West *et al*

n = 15]) and/or out-of-hospital personnel (between 1% and 70% [mean = 22%, n = 14]) while treating victims of biological or chemical agents. Finally, only five states indicate that all hospitals have decontamination capabilities. Twenty-three states suggested that between 5% and 90% (mean = 21%) of hospitals statewide have decontamination capabilities.

Disaster Capacity

Eight states reported that a statewide system was in place to link information on hospital bed status, staffing availability and level of supplies among facilities (Table 7). Only five additional states indicated that >50% of the state population was covered by such a system. Additionally, a total of eleven states reported that statewide agreements or protocols existed governing the transfer of patients out of over-saturated facilities. Six additional states indicated that on average, 40% of the population were covered by such a plan (range 10% to 80%). In a related question, 24% of states reported that contingency plans were available for increasing in-patient capacity in the event of a disaster. Among 12 states, protocols exist for deploying medical teams from hospitals into the field in the event of a disaster. Four additional states reported that protocols were in place to deploy medical teams to the field in specific regions of the state. Finally, there were 24 states with formal contingency plans for instances when the number of patients to be transported from the field exceeded the capacity of local emergency transport systems. Three additional states reported regional or local protocols to address over-saturation of EMS transport services in the service areas affected by a disaster.

Association between Readiness and Existing Emergency Programs

Approximately 120 MMRS projects have been funded in cities throughout the United States since inception of the program. The number of MMRS projects funded in each state from 1977 to 2001 was not significantly associated

Disaster Planning

1. Does a written statewide disaster plan exist that addresses health and medical response?
2. Are all state and local disaster plans tested with activation of the health and medical system components?
3. Are mock disaster drills conducted on a statewide basis that test health and medical response capabilities?
4. Do all state and local disaster plans include a bioterrorism component?
5. Do all state and local disaster plans include components for livestock, crops, and feed?

Disaster Coordination and Communication

1. Is there a state operations center that would have designated responsibility in the event of a natural or man-made calamity?
2. Is there a formal statewide mechanism to cooperatively develop protocols for multiple-casualty incidents?
3. Are there statewide contingency plans for dealing with possible shortages of physicians, nurses, pharmacists and other healthcare professionals?
4. Is there a secure and continuously operating communications system separate from the public telecommunications system that links health and medical resources within the state?
5. Does your state participate in a CDC disease/disaster surveillance system?
6. Does your state have a state-based disaster surveillance system?

Disaster Training

- 1–3. Is training offered / required statewide among hospital personnel in the following areas: (Disaster Management, Biological Terrorism, Chemical Terrorism)?^a
- 4–6. Is training offered / required statewide among EMS personnel in the following areas: (Disaster Management, Biological Terrorism, Chemical Terrorism)?^a

Preparedness for Biological or Chemical Terrorism

1. Is adequate personal protective equipment immediately available statewide in the event of biological or chemical terrorism for EMS personnel?
2. Is adequate personal protective equipment immediately available statewide in the event of biological or chemical terrorism for hospital personnel?
3. Are resources available statewide for the treatment of victims of biological or chemical terrorism that would not endanger other patients and healthcare providers in-hospital?
4. Are resources available statewide for the treatment of victims of biological or chemical terrorism that would not endanger other patients and healthcare providers out-of-hospital?
5. Do all hospitals have decontamination capabilities?

Disaster Capacity

1. Is there a statewide system in place to link information on hospital bed status, staffing availability, and level of supplies?
2. Are there statewide established agreements or protocols governing the transfer of patients out of over-saturated facilities?
3. Are there statewide contingency plans for increasing in-patient capacity in the event of a disaster?
4. Are there statewide medical teams to deploy from hospitals into the field?
5. Are there statewide contingency plans for instances in which the number of patients to be transported exceeds the capacity of local emergency transport systems?

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Table 2—State disaster readiness survey questions by category.^b (^aItems assessed separately. ^bItems queried whether statewide coverage was available for each attribute of readiness, i.e., yes or no)

State	Written Statewide Disaster Plan	Plan Tested With Activation	Mock Disaster Drills Conducted	Plan Has Bioterrorism Component	Plan Indicates Livestock and Crops
Alabama	Yes*	Yes	No	30%	Unknown
Alaska	Yes	No ^a	No	Yes	No
Arizona	Yes	Yes	Yes	95%	Unknown
Arkansas	Yes	30%	30%	1%	Unknown
California	Yes	No	Yes	No	No
Colorado	50% ^b	No	No	No	No
Connecticut	Yes	Unknown	Yes	Yes	Yes
Delaware	Yes	No	Yes	Yes	No
Florida	Yes	Yes	Yes	Unknown	Yes
Georgia	Yes	Yes	Yes	Yes	Yes
Hawaii	Yes	80%	Yes	80%	Yes
Idaho	Yes	70%	75%	Unknown	Unknown
Illinois	Yes	Yes	Yes	Yes	No
Indiana	Yes	Yes	Yes	Yes	Yes
Iowa	Yes	Yes	Yes	Yes	Yes
Kansas	Yes	No	Yes	Yes	Yes
Kentucky	Yes	Yes	Yes	No	No
Louisiana	Yes	Yes	Yes	Yes	No
Maine	Yes	No	Yes	Yes	Yes
Maryland	Yes	Yes	Yes	20%	No
Massachusetts	Yes	No	Yes	No	Unknown
Michigan	Yes	Unknown	No	No	Unknown
Minnesota	Yes	No	No	No	No
Mississippi	Yes	Yes	Yes	Yes	Yes
Missouri	Yes	Yes	No	Unknown	Unknown
Montana	Yes	50%	No	No	No
Nebraska	Yes	Yes	Yes	No	No
Nevada	85%	6%	85%	6%	Unknown
New Hampshire	85%	85%	85%	20%	No
New Jersey	Yes	Yes	Yes	Yes	Yes
New Mexico	Yes	Yes	Yes	Yes	Yes
New York	Yes	Yes	No	Yes	Yes
North Carolina	Yes	Yes	Yes	10%	10%
North Dakota	Yes	No	No	Yes	Yes
Ohio	Yes	No	No	Yes	Unknown
Oklahoma	Yes	Yes	Yes	Yes	No
Oregon	Yes	50%	No	15%	Unknown
Pennsylvania	Yes	Yes	Yes	50%	Yes
Rhode Island	Yes	Yes	Yes	No	Yes
South Carolina	Yes	Yes	Yes	No	Yes
South Dakota	Yes	75%	Yes	10%	No
Tennessee	Yes	Yes	Yes	Yes	Yes
Texas	Yes	Yes	Yes	Yes	Yes
Utah	Yes	80%	Unknown	70%	Unknown
Vermont	Yes	Yes	No	No	No
Virginia	Yes	No	25%	25%	10%
Washington	Yes	Unknown	No	No	Unknown
West Virginia	Yes	No	No	No	No
Wisconsin	Yes	No	No	25%	No
Wyoming	Yes	No	Yes	30%	Yes
Total Yes	47 (94%)	24 (48%)	29 (58%)	19 (38%)	19 (38%)
Total Partial	3 (6%)	9 (18%)	5 (10%)	15 (30%)	2 (4%)
Total No	0	14 (28%)	15 (30%)	13 (26%)	17 (34%)
Total Unknown	0	3 (6%)	1 (2%)	3 (6%)	12 (24%)

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Table 3—Survey responses on disaster planning by state (*Statewide coverage, ^aVery limited or no plans or programs available, ^bLimited plans or programs available; percent of the State population covered by plans or programs)

State	State Operations Center	Protocols for MCI	Plan for Possible Professional Shortages	Available Communications System	CDC Disaster Surveillance System	State-based Disaster Surveillance System
Alabama	Yes*	Yes	Yes	No	Unknown	Yes
Alaska	Yes	Yes	Yes	No	Yes	Yes
Arizona	Yes	Yes	Yes	95%	Yes	No
Arkansas	Yes	No ^a	No	No	Yes	No
California	Yes	80% ^b	Yes	60%	Yes	Yes
Colorado	Yes	No	No	No	Unknown	No
Connecticut	Yes	Yes	Unknown	Yes	Yes	Yes
Delaware	Yes	No	No	50%	No	No
Florida	Yes	Yes	Yes	Yes	Yes	Yes
Georgia	Yes	Yes	Unknown	Yes	Yes	Yes
Hawaii	Yes	Yes	Unknown	Yes	Yes	Yes
Idaho	Yes	Yes	Yes	Yes	Yes	No
Illinois	Yes	Yes	No	Yes	Yes	No
Indiana	Yes	No	No	No	Yes	No
Iowa	Yes	Yes	Yes	Yes	Yes	Yes
Kansas	Yes	No	50%	No	Yes	Yes
Kentucky	Yes	Yes	Yes	No	Yes	No
Louisiana	Yes	Yes	No	No	Yes	Yes
Maine	Yes	Yes	No	No	Yes	Yes
Maryland	Yes	Yes	Yes	Yes	Yes	Yes
Massachusetts	Yes	Yes	No	75%	Yes	No
Michigan	Yes	Yes	No	No	No	No
Minnesota	Yes	Yes	No	Yes	Yes	No
Mississippi	Yes	Yes	Yes	Yes	Yes	Yes
Missouri	Yes	Unknown	Unknown	Unknown	Yes	Yes
Montana	Yes	50%	No	50%	No	No
Nebraska	Yes	No	No	No	No	Yes
Nevada	Yes	85%	6%	No	Yes	Yes
New Hampshire	Yes	No	8%	No	Yes	No
New Jersey	Yes	Yes	No	Yes	Yes	Yes
New Mexico	Yes	Yes	Yes	Yes	Yes	Yes
New York	Yes	Yes	Yes	Yes	Yes	Yes
North Carolina	Yes	Yes	Yes	No	No	No
North Dakota	Yes	Unknown	Yes	Yes	Yes	Yes
Ohio	Yes	Unknown	No	No	Yes	Yes
Oklahoma	Yes	Yes	60%	20%	Yes	Unknown
Oregon	Yes	Yes	No	No	No	No
Pennsylvania	Yes	Yes	50%	50%	Yes	Yes
Rhode Island	Yes	Yes	Yes	Yes	Yes	Yes
South Carolina	Yes	Yes	Yes	No	Yes	Yes
South Dakota	Yes	75%	No	No	Unknown	No
Tennessee	Yes	Yes	Yes	No	Yes	Unknown
Texas	Yes	Yes	Yes	Yes	Yes	Yes
Utah	Yes	Yes	70%	Yes	Yes	Yes
Vermont	Yes	Yes	No	No	Yes	Yes
Virginia	Yes	Yes	No	No	Yes	No
Washington	Yes	No	No	No	No	Unknown
West Virginia	Yes	Yes	Yes	Yes	Yes	Yes
Wisconsin	Yes	No	No	No	Yes	Yes
Wyoming	Yes	50%	No	30%	Yes	No
Total Yes	50 (100%)	33 (66%)	19 (38%)	18 (36%)	40 (80%)	29 (58%)
Total Partial	0	5 (10%)	6 (12%)	8 (16%)	0	0
Total No	0	9 (18%)	21 (42%)	23 (46%)	7 (14%)	18 (36%)
Total Unknown	0	3 (6%)	4 (8%)	1 (2%)	3 (6%)	3 (6%)

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Table 4—Survey responses on disaster coordination and communication by state (MCI = mass-casualty incident; Statewide coverage; ^aVery limited or no plans or programs available; ^bLimited plans or programs available, percent of the State population covered by plans or programs)

State	HP O/R Disaster	HP O/R Biological	HP O/R Chemical	EMS-P O/R Disaster	EMS-P O/R Biological	EMS-P O/R Chemical
Alabama	No / Unknown*	No / Unknown	No / Unknown	No / No	No / No	No / No
Alaska	Yes†/ No‡	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Arizona	Yes / No	Yes / No	No / No	Yes / No	No / No	No / No
Arkansas	No / No	No / No	No / No	Yes / No	Yes / No	Yes / No
California	33%§ / Yes	33% / 33%	33% / 33%	40% / Yes	40% / 40%	40% / 40%
Colorado	No / No	No / No	No / No	No / No	No / No	No / No
Connecticut	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Delaware	Yes / Yes	Yes / No	Yes / No	Yes / Yes	Yes / Yes	Yes / Yes
Florida	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Georgia	Yes / Unknown	Yes / Unknown	Yes / Unknown	Yes / No	Yes / No	Yes / No
Hawaii	Yes / Yes	No / No	No / No	Yes / Yes	No / No	No / No
Idaho	Yes / Unknown	Yes / Unknown	Yes / Unknown	Yes / Unknown	Yes / No	Yes / No
Illinois	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Indiana	50% / No	50% / No	50% / No	70% / No	70% / No	70% / No
Iowa	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Kansas	Unknown / No	Unknown / No	Unknown / No	Yes / No	Yes / No	Yes / No
Kentucky	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Louisiana	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Maine	Yes / Unknown	Yes / No	Yes / Unknown	Yes / No	Yes / No	Yes / No
Maryland	Yes / 40%	Yes / No	Yes / 10%	Yes / 40%	Yes / 5%	Yes / 10%
Massachusetts	Yes / Yes	No / No	No / No	No / No	No / No	No / No
Michigan	Yes / No	No / No	No / No	Yes / No	No / No	No / No
Minnesota	Yes / Unknown	Yes / Unknown	Yes / Unknown	Yes / No	Yes / No	Yes / No
Mississippi	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Missouri	80% / Yes	75% / No	75% / No	80% / 80%	75% / No	No / Yes
Montana	No / No	25% / No	No / No	No / No	No / No	No / No
Nebraska	Yes / No	Yes / No	No / No	Yes / No	Unknown / No	Unknown / No
Nevada	6% / 4%	6% / 4%	6% / 4%	20% / 20%	20% / 20%	20% / 20%
New Hampshire	No / No	No / No	No / No	No / No	No / No	No / No
New Jersey	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
New Mexico	Unknown / No	Unknown / No	Unknown / No	Yes / No	Yes / No	Yes / No
New York	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
North Carolina	10% / No	Yes / No	No / No	Yes / Yes	10% / No	Yes / Yes
North Dakota	Yes / No	Yes / No	Yes / No	No / No	No / No	No / No
Ohio	Unknown / No	Unknown / No	Unknown / No	Yes / No	Yes / No	Yes / No
Oklahoma	20% / No	20% / No	20% / No	20% / 10%	20% / 10%	20% / 10%
Oregon	No / No	No / No	No / No	Yes / Yes	No / No	No / No
Pennsylvania	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
Rhode Island	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No
South Carolina	Yes / No	Yes / No	Yes / No	No / No	No / No	No / No
South Dakota	No / No	Yes / 1%	35% / 1%	No / No	Yes / No	Yes / No
Tennessee	Yes / Yes	Yes / Yes	Yes / Yes	Yes / No	Yes / No	Yes / No
Texas	80% / No	80% / No	80% / No	Yes / Yes	Yes / No	Yes / No
Utah	70% / Yes	70% / 40%	70% / 40%	70% / No	70% / No	70% / No
Vermont	Yes / Unknown	Yes / Unknown	Yes / Unknown	Yes / No	Yes / No	Yes / No
Virginia	10% / No	15% / No	15% / No	95% / Unknown	10% / Unknown	75% / No
Washington	No / No	No / No	No / No	No / No	No / No	No / No
West Virginia	Yes / Yes	Yes / Yes	Yes / Yes	Yes / No	Yes / No	Yes / No
Wisconsin	No / No	No / No	No / No	No / No	No / No	No / No
Wyoming	No / No	No / No	No / No	No / No	No / No	No / No
Total Yes	28 (56%) / 8 (16%)	27 (54%) / 2 (4%)	23 (46%) / 2 (4%)	32 (64%) / 6 (12%)	27 (54%) / 1 (2%)	28 (56%) / 3 (6%)
Total Partial	9 (18%) / 2 (4%)	9 (18%) / 4 (8%)	9 (18%) / 5 (10%)	7 (14%) / 4 (8%)	8 (16%) / 4 (8%)	6 (12%) / 4 (8%)
Total No	10 (20%) / 34 (68%)	11 (22%) / 39 (78%)	15 (30%) / 37 (74%)	11 (22%) / 38 (76%)	14 (28%) / 44 (88%)	15 (30%) / 43 (86%)
Total Unknown	3 (6%) / 6 (12%)	3 (6%) / 5 (10%)	3 (6%) / 6 (12%)	0 / 2 (4%)	1 (2%) / 1 (2%)	1 (2%) / 0

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Table 5—Survey responses on disaster training by state (EMS-P = emergency medical services personnel, HP = hospital personnel, O/R = Offer/Require, *Two responses per cell: training offered / training required, †Statewide coverage, ‡Program not offered (or required), §Limited statewide coverage; percent of the State population covered in process)

State	Adequate Protective Equipment EMS	Adequate Protective Equipment Hospital	Resources to Treat Victims in Hospital	Resources to Treat Victims Out of Hospital	Hospitals Have Decontamination Capabilities
Alabama	No*	No	No	No	90%
Alaska	50%†	50%	No	No	25%
Arizona	25%	No	No	Unknown	No
Arkansas	10%	5%	No	No	5%
California	10%	10%	Yes‡	Yes	Yes
Colorado	No	No	No	No	No
Connecticut	5%	5%	5%	5%	10%
Delaware	50%	30%	No	No	Yes
Florida	No	No	No	No	No
Georgia	50%	50%	Yes	Yes	Yes
Hawaii	2%	1%	No	No	20%
Idaho	5%	10%	20%	5%	Unknown
Illinois	No	No	No	No	No
Indiana	40%	25%	15%	25%	50%
Iowa	No	No	Yes	Yes	15%
Kansas	No	No	Unknown	Unknown	Unknown
Kentucky	25%	25%	Yes	Yes	No
Louisiana	No	No	60%	50%	No§
Maine	No	No	No	No	10%
Maryland	30%	10%	1%	1%	10%
Massachusetts	Unknown	Unknown	Unknown	Unknown	Yes
Michigan	No	No	No	No	Unknown
Minnesota	No	No	No	No	No
Mississippi	10%	10%	10%	20%	15%
Missouri	Unknown	Unknown	Unknown	Unknown	Unknown
Montana	1%	1%	1%	1%	5%
Nebraska	Unknown	Unknown	No	No	Unknown
Nevada	8%	2%	6%	6%	6%
New Hampshire	2%	No	No	No	18%
New Jersey	No	Yes~	Yes	Yes	50%
New Mexico	30%	20%	No	No	No
New York	50%	75%	50%	50%	20%
North Carolina	1%	1%	1%	1%	5%
North Dakota	No	No	50%	50%	Unknown
Ohio	Yes	No	No	No	No
Oklahoma	30%	20%	10%	No	10%
Oregon	10%	10%	30%	10%	15%
Pennsylvania	No	No	20%	20%	No
Rhode Island	2%	1%	No	No	No
South Carolina	10%	10%	Yes	Yes	25%
South Dakota	No	No	No	No	No
Tennessee	No	No	No	No	Unknown
Texas	50%	25%	Yes	Yes	13%
Utah	50%	70%	70%	70%	25%
Vermont	No	No	Yes	Yes	Yes
Virginia	No	No	No	No	25%
Washington	No	No	Unknown	Unknown	No
West Virginia	No	No	Unknown	Unknown	No
Wisconsin	No	No	No	No	Unknown
Wyoming	No	No	No	No	15%
Total Yes	1 (2%)	1 (2%)	8 (16%)	8 (16%)	5 (10%)
Total Partial	25 (50%)	23 (46%)	15 (30%)	14 (28%)	23 (46%)
Total No	21 (42%)	23 (46%)	22 (44%)	22 (44%)	14 (28%)
Total Unknown	3 (6%)	3 (6%)	5 (10%)	6 (12%)	8 (16%)

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Table 6—Survey responses on preparedness for biological or chemical terrorism by state (EMS = emergency medical services, *Limited or no resources available, †Limited resources available; percent of the State population covered by resources, ‡Statewide coverage, §In process, ~For biological terrorism only)

State	System Linking Health Information	Patients From Saturated Facilities	Increase In-Patient Capacity	Deploy Medical Teams to Field	Contingency Plans When Capacity Exceeded
Alabama	No*	No	No	No	No
Alaska	No	No	No	Yes	Yes
Arizona	No	No	No	No	No
Arkansas	No	No	No	No	Yes
California	60%†	80%	Yes	No	80%
Colorado	No	Unknown	Unknown	No	No
Connecticut	No	No	No	No	Yes
Delaware	No	No	No	No	Yes
Florida	Yes‡	Yes	Yes	Yes	Yes
Georgia	Unknown	Unknown	Unknown	Yes	Yes
Hawaii	80%	Yes	Yes	Yes	Yes
Idaho	No	No	No	No	No
Illinois	No	No	Yes	Yes	Yes
Indiana	10%	10%	No	Yes	No
Iowa	No	Yes	Yes	No	Yes
Kansas	Unknown	Unknown	Unknown	Unknown	Unknown
Kentucky	No	No	No	No	Yes
Louisiana	Yes	No§	Yes	No§	No§
Maine	No	No	No	No	Yes
Maryland	Yes	No	No	Yes	Yes
Massachusetts	Unknown	Unknown	Unknown	Yes	No
Michigan	No	No	No	No	No
Minnesota	No	No	No	No	No
Mississippi	No	50%	No	30%	80%
Missouri	No	Yes	Yes	Unknown	Unknown
Montana	No	No	No	No	Yes
Nebraska	No	No	No	No	No
Nevada	No	No	85%	4%	Yes
New Hampshire	25%	25%	90%	No	Yes
New Jersey	Yes	Yes	Yes	Yes	Yes
New Mexico	Yes	Yes	Yes	Yes	Yes
New York	Yes	Yes	Yes	No	Yes
North Carolina	No	No	No	No	75%
North Dakota	No	No	No	No	Yes
Ohio	No	No	No	No	No
Oklahoma	60%	60%	No	No	No
Oregon	No	Yes	No	15%	No
Pennsylvania	50%	No	No	20%	Yes
Rhode Island	No	Yes	Yes	No	Yes
South Carolina	Yes	No	No	Yes	Yes
South Dakota	No	No	No	No	No
Tennessee	No	No	No	No	No
Texas	38%	Yes	Yes	Yes	Yes
Utah	70%	Unknown	70%	No	No
Vermont	Yes	Yes	No	No	No
Virginia	No	No	No	No	Yes
Washington	No	No	No	No	No
West Virginia	No	No	No	No	No
Wisconsin	15%	15%	No	No	No
Wyoming	No	No	No	No	No
Total Yes	8 (16%)	11 (22%)	12 (24%)	12 (24%)	24 (48%)
Total Partial	9 (18%)	6 (12%)	3 (6%)	4 (8%)	3 (6%)
Total No	30 (60%)	28 (56%)	31 (62%)	32 (64%)	21 (42%)
Total Unknown	3 (6%)	5 (10%)	4 (8%)	2 (4%)	2 (4%)

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Table 7—Survey responses on disaster capacity by state (*Very limited or no plans or programs available, †Limited plans or programs available; percent of the State population covered by plans or programs, ‡Statewide coverage, §In process)

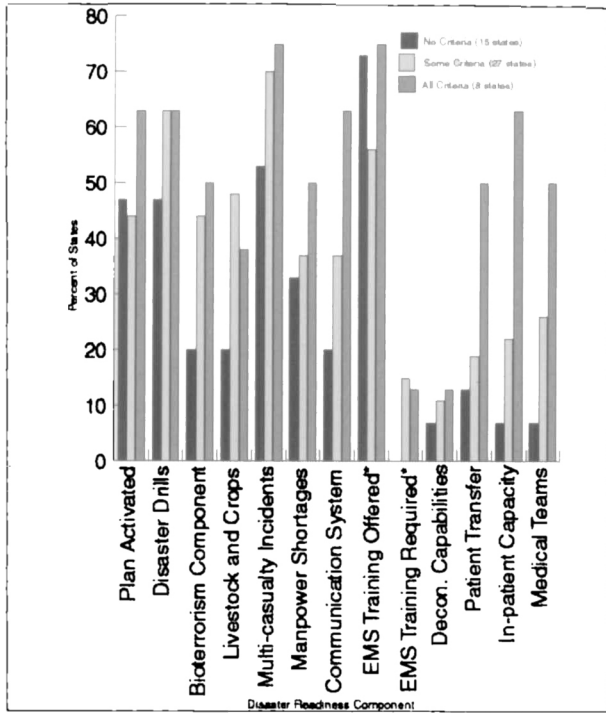


Figure 1—Key disaster readiness components by three levels of trauma system maturity (*Statewide training in disaster management, biological terrorism, or chemical terrorism; Decon. = Decontamination)

statistically with overall state readiness ($r = 0.152$, $p = 0.292$), nor was the elapsed time that each MMRS project has been in place ($r = 0.164$, $p = 0.256$). There was, however, a significant association between overall statewide disaster readiness and the maturity of state-level trauma systems in each state ($p = 0.019$). States with no legislated trauma system were least prepared for a mass disaster event (mean rank = 17.2), followed by states satisfying 3–5 of the West criteria (mean rank = 27.6). States with a mature, well-organized, statewide trauma system were most likely to demonstrate components of preparedness, as assessed by the survey (mean rank = 33.7). Figure 1 identifies key statewide disaster readiness components by the level of trauma system maturity. The figure suggests that trauma system development may enhance communication “links” among medical resources and augment protocols aimed at increasing healthcare capacity in a mass-casualty event.

Discussion

The initial response to any catastrophic event requires that local community authorities take preliminary steps to establish an incident command system and centralize the coordination of local resources. Simultaneously, local emergency managers should assess the situation and determine what assistance, if any, through mutual-aid agreements with neighboring jurisdictions or the state is warranted. Once a request has been received, the state is expected to respond with the resources necessary to match the request.

A state response begins with activation of an emergency response operation, which resonates through all aspects of public health and the medical community (i.e., EMS agencies, fixed site medical facilities, etc.). The activation of offices and agencies must occur quickly according to predefined protocols designed to reduce redundancy and streamline communications when interfacing with local and federal agencies.

At the time of the survey, few states had implemented the programs necessary to ensure a prompt and effective response to a mass-casualty event. Although disaster plans were prevalent among all states, key programs and policies were noticeably absent. Communication systems across states were fragmented, severely limiting a state’s ability to identify and contain a biological and/or chemical event or orchestrate any type of mass care. Adequate training programs and protective equipment for health personnel were also markedly lacking among most states. The findings are similar to other published reports based upon municipal data. For example, a survey conducted in the year 2000 by the National Association of County and City Health Officials (NACCHO) indicated that 84% of responding communities had disaster plans with roles for public health entities, but only 24% addressed bioterrorist events.¹³

Historically, federal programs addressing domestic preparedness have originated from legislative earmarks rather than from a national strategic plan, resulting in local redundancy and poor integration with existing state resources.¹⁴ This may explain why the establishment and maintenance of MMRS programs were not associated with state-level disaster preparedness. The majority of early MMRS projects focused on fire and police agency preparedness for chemical terrorism in narrowly defined urban areas. While these specialized projects have merit, local public health and medical communities often are poorly integrated, making it difficult to massage disjointed programs into a seamless statewide disaster plan.

The presence of a legislated statewide trauma system signifies the presence of an underlying “grassroots” integration of the public health and medical communities. Authors have suggested that the success of a statewide disaster preparedness plan is contingent on the establishment and exploitation of adequate logistical arrangements for materials, equipment, and personnel.¹⁴ Ensuring the timely transfer of injured patients to facilities certified to contain the appropriate services, expertise and resources is a mantra of trauma system development.

Previously published reports suggest that state disaster readiness may be reflective of the level of integration between public health agencies and the medical community. The NACCHO survey reported that on average, only 5% of appropriate personnel in local public health agencies received bioterrorism training; except for in West Virginia, where bioterrorism training is required among hospital personnel, and where 72% of county health directors had received bioterrorism training.¹⁰

There are several important limitations associated with this report. Study findings are based entirely on survey results, which carry inherent risks for reporting error and bias. The fact that surveys were completed by state stake-

holder groups may reduce the possibility of reporting error and lessen the opportunity for individual biases. Nevertheless, some survey questions were difficult to answer. For example, queries regarding protective equipment often "lumped" chemical and biological preparedness into the same question.

Because most survey questions queried states about statewide processes, some of the subtleties in regional or local programs may not have been detected, even though respondents were able to indicate percentages of the state population covered by regional or local programs. It also should be noted that a state may indicate that a mandate or process is in place, but, this information alone does not demonstrate that the process is fully implemented and/or active.

Finally, it should be noted that the composition of state stakeholder groups favored hospital and EMS trauma experience. This focus of opinions may have swayed the correlative analysis. Nevertheless, survey questions centered on disaster management and, although additional attendees may have widened the perspective, survey responses most likely are accurate.

The findings are reflective of state preparedness as of the first quarter of 2002. Since that time, most states have made tremendous progress in improving their readiness for mass-casualty events. The recent establishment of the Department

of Health and Human Services Assistant Secretary's Office of Public Health Emergency Preparedness and the Department of Homeland Security aim to provide "point sources" of information and resources to aid in state-level preparedness.¹⁵ Future federal programs such as these may greatly enhance a state's ability to manage diverse organizations and agencies involved in a mass-casualty event, providing seamless coordination of command, control, communications, and information management among local, state, and federal sources. The findings of this survey provide a baseline upon which states can target funding and gauge progress towards enhanced levels of disaster preparedness.

Acknowledgement

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