

# A Pilot Assessment of Hospital Preparedness for Bioterrorism Events

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## Abbreviations:

AHRQ = Agency for Healthcare Research and Quality  
CAH = Critical Access Hospitals  
CBRNE = chemical, biological, radiation, nuclear, and explosive  
CMS = Centers for Medicare and Medicaid Services  
HHS = US Department of Health and Human Services  
HRSA = Health Resources Services Administration  
MSA = Metropolitan Statistical Area  
PPE = personal protection equipment

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## Abstract

**Objective:** Lessons on question content and refinement of a 2003 Agency for Healthcare Research and Quality-Health Resources Services Administration (AHRQ-HRSA) pilot hospital preparedness assessment tool designed to capture activities in more detail than previous studies are reported in this study.

**Methods:** Responses from fixed-choice questions, including organizational and geographical differences, were analyzed using the chi-square test. Open-ended questions were evaluated qualitatively.

**Results:** Of the respondents, 91% had developed plans and 97% designated a bio-event coordinator, but only 47% had allocated funds. Urban hospitals were more likely to participate in regional infectious disease monitoring. Hospitals that participated in a network were more likely to fund preparedness, share bio-event coordinators and medical directors, and provide advanced training.

**Conclusions:** Several issues deserve further study: (1) hospital networks may provide the structure to promote preparedness; (2) specific procedures (e.g., expanding outpatient treatment capacity) have not been tested; and (3) special attention should be directed towards integrating non-urban hospitals into regional surveillance systems to ensure early identification of infectious disease outbreaks.

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## Introduction

In September 2000, the US Department of Health and Human Services (HHS) launched a (US)\$5 million bioterrorism prevention, planning, and research initiative that focused on clinical preparedness of healthcare providers and healthcare systems. Although recent reports on hospital bioterrorism preparedness have suggested some progress, many shortfalls have been identified, including: (1) training; (2) decontamination capabilities; (3) internal communications (with staff); (4) external communications (with community agencies and the public); and (5) medical equipment (including personal protective equipment (PPE)).<sup>1-5</sup> In addition, the results of these studies cannot be generalized to US hospitals, since the hospitals surveyed predominantly were urban and not geographically representative.

Hospital characteristics (e.g., location, size, and affiliation) may influence preparedness. Rural hospitals might be particularly vulnerable to a bioterrorism event. A recent report suggests that they tend to be resource-strapped and more likely to have limited surge capacity, healthcare worker shortages, and limited communication capabilities because of radio signal interference due to geography and terrain.<sup>5</sup> Moreover, geographic isolation might limit their opportunities to integrate their preparedness activities with other hospitals. In more general terms, if a hospital works to achieve bioterrorism preparedness in isolation from other hospitals, this might not be as efficient or effective as working collaboratively. This suggests that hospitals in a network of other hospitals or as member of a single hospital system, could achieve efficiencies by sharing resources (such as personnel) to develop, implement, and test plans and procedures. Additionally, plans or procedures to improve response capability should be tested, preferably through drills or in response to actual events.

Characteristic	n	%
In MSA	98	88.3
Bed number		
≤100	14	14.4
100-199	36	32.4
200-299	28	25.2
>300	31	27.9
Hospital type		
Medical surgical	91	82.0
Teaching	38	34.2
Critical Access Hospital*	4	3.6
Non-Urban	11	9.9
Sole community	17	15.3
In a network or system**	39	35.1
Trauma Certification		
Highest (Level-I)	9	8.1
High (Level-II)	21	18.9
Medium (Level-III)	16	14.4
Low (Level-IV)	4	3.6
No certification	61	55.0
State		
Pennsylvania	41	36.9
Massachusetts	23	20.7
New Jersey	17	15.3
Michigan	9	8.1
Delaware	9	8.1
Colorado	6	5.4
Rhode Island	3	2.7
Hawaii	3	2.7

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**Table 1**—Hospital characteristics (MSA = Metropolitan Statistical Area)

\* Small (25 beds or fewer) rural or state designated as necessary provider hospital with 24-hour emergency access

\*\* Member of a hospital network or single hospital system.

*AHRQ-HRSA Bioterrorism Preparedness Assessment Tool*  
In 2003, the US Agency for Healthcare Research and Quality (AHRQ) (agency of HHS that conducts research designed to improve the quality, safety, efficiency, and effectiveness of health care) and US Health Resources Services Administration (HRSA) (agency of HHS that serves to improve access to health care) fielded a pilot assessment tool entitled *Bioterrorism Emergency Planning and Preparedness Questionnaire for Healthcare Facilities*. This instrument was designed to assess preparedness.

The lessons learned from an AHRQ-HRSA hospital pilot assessment tool designed to guide future data gathering on hospital bioterrorism preparedness are identified in this study.

## Methods

### Study Design

The goal of this study was to refine questions that assess benchmarks of regional bioterrorism preparedness. Institutional

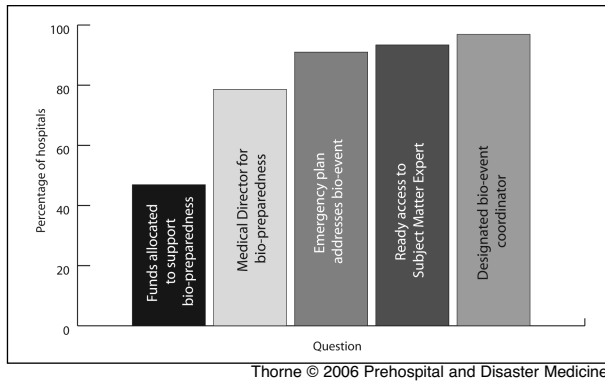
Review Board (IRB) approval for the analysis was obtained from the University of Maryland. Approval included a waiver of the respondent hospitals' consent, since the survey already had been completed.

### Study Setting and Population

The questionnaire was administered by AHRQ-HRSA in a non-randomized manner to an unknown number of hospitals in six (of 10) HRSA regions, and 111 hospitals from eight states provided their responses (80%). Because 73% of the respondent hospitals were located in three states (Pennsylvania, New Jersey, and Massachusetts), the results are not representative of all 10 of the HRSA regions.

### Assessment Tool: Bioterrorism Preparedness Questionnaire for Healthcare Facilities

To assess bioterrorism preparedness, the AHRQ-HRSA established three criteria for the assessment tool. The ques-



**Figure 1**—Administrative actions

tions had to be: (1) bioterrorism-specific and not duplicate the generic, mass-casualty protocols of a facility's emergency management plan; (2) focused on issues that are under the responsibility and control of hospital leadership; and (3) achievable to even the smallest hospital.

An expert panel, including emergency and occupational medicine professionals and others with expertise in assessment tool design, was convened by Booz Allen Hamilton, a global consulting firm. The team adapted (with permission) several hospital preparedness tools and reports to craft the questionnaire.<sup>8-10</sup> To streamline the tool, the following criteria were applied: (1) regional issues were limited to those activities involving hospital participation and roles; (2) questions were designed for benchmarking purposes (i.e., avoiding the use of open-ended responses, wherever possible) and directly addressed preparedness and capacity to respond to a large-scale, bioterrorism event; and (3) response choices were tied to measures of readiness. Most questions and responses were presented in the following format:

**Question:** Has the hospital achieved [a specific preparedness goal—e.g., written bioterrorism response plan]?

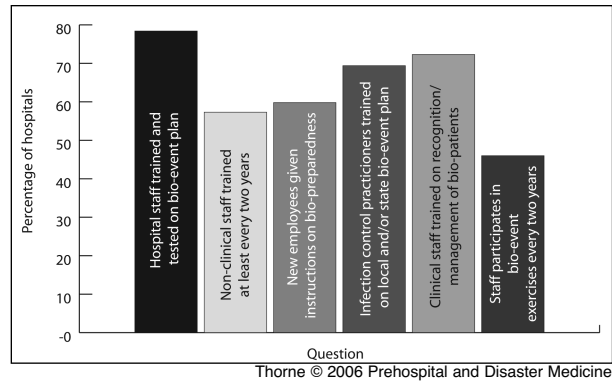
**Response categories:**

1. No, and [the activity is] not planned within the next six months;
2. No, but [the activity is] planned within the next six months;
3. [The activity is] currently in development;
4. Yes, but [there is some limitation to the activity—e.g., not formalized];
5. Yes, and the hospital is fully prepared; or
6. Other (this option permitted the respondent to write in an answer).

By including an "other" option for many questions and prompting the respondent to write in responses, the assessment tool could be used to collect narrative responses that would help refine the response categories for future questionnaires. The questionnaire is available online.<sup>11</sup>

#### Measurements

Four variables related to facility characteristics were obtained from publicly available data and supplemented the assessment tool. These included demographic charac-



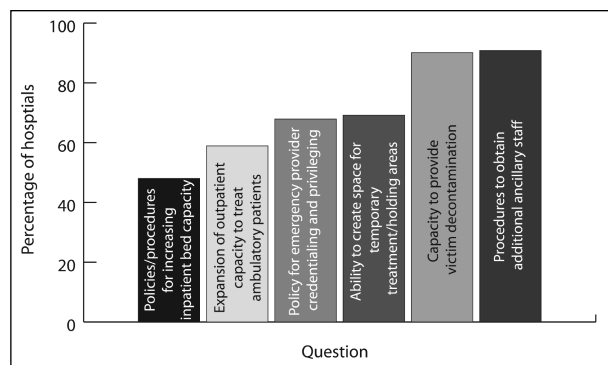
**Figure 2**—Education, training, and drills

teristics such as hospital size, metropolitan statistical area (MSA), Critical Access Hospital (CAH), and whether the facility is in a network with other hospitals or is a member of a single hospital system. Hospital size was categorized by the number of staff beds reported in 2002 to the American Hospital Association.<sup>12</sup> This variable was collapsed into four categories: (1) 1–99 beds; (2) 100–199 beds; (3) 200–299 beds; and (4)  $\geq 300$  beds. Metropolitan Statistical Area status was determined from US Census Bureau data.<sup>13</sup> Hospitals that are small (<25 beds) and isolated may have been designated by the Centers for Medicare and Medicaid Services (CMS) as CAH for funding purposes; these represent an extreme subset of rural hospitals. Critical Access Hospital status was verified using the CMS Website.<sup>14</sup> It was determined whether a hospital was in a network or system directly from the Websites of individual respondent hospitals.

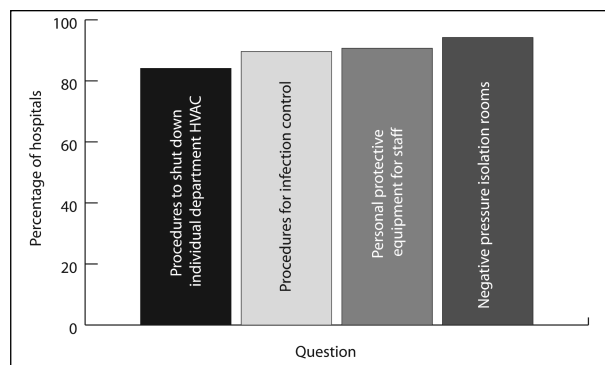
The remaining variables were extracted directly from the hospitals' responses to the questionnaire. The assessment tool questions contained 2–5 response categories, plus an additional "other" category for most questions. All "other" responses were coded as a missing value. For the bivariate comparisons and Figures 1–6, preparedness responses were collapsed into "no" (meaning either "no, not planned"; "planned but not yet"; or "planning in progress") and "yes" ("yes"; "yes but some specified goal not met"; or "yes and some specified goal met"). For four questions (one relating to funding, another related to education and training, and two others relating to participation in regional systems to monitor inpatient bed capacity and emergency department diversion status), the variables were collapsed so that a "yes" response required that a specified goal be met. Specifically, "yes" meant funds had been distributed for bioterrorism preparedness (not just received), or that training was tested, or that monitoring of inpatient bed capacity or emergency department diversion status was in real-time. Finally, the variable for trauma certification level had four response categories—Level I (highest level of care, coded 1) through Level IV (lowest, coded 4).

#### Data Processing

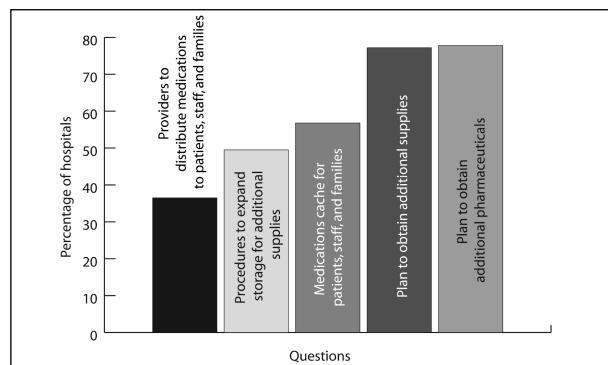
This study describes the characteristics of the responding hospitals listed in Table 1, and describe hospital preparedness by current HRSA benchmarks (i.e., achievements) represented in Figures 1–6. The qualifications of the bio-event coordinators



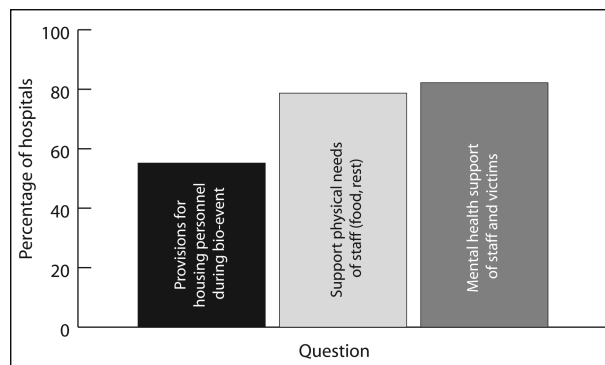
**Figure 3A**—Surge capacity: Beds, personnel, and decontamination



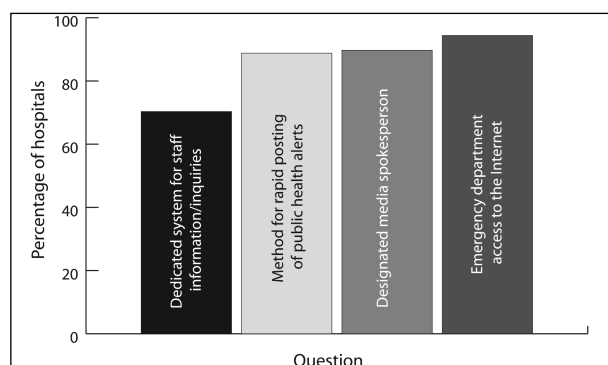
**Figure 3B**—Surge capacity: Isolation rooms and personal protective equipment



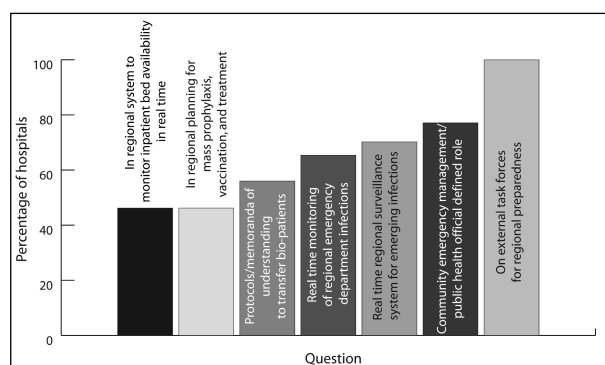
**Figure 3C**—Surge capacity: Pharmaceuticals, supplies, and equipment



**Figure 4**—Staff support



**Figure 5**—Communication systems



**Figure 6**—Integration with local or regional systems

(*bio-event* refers to either a natural or intentional event involving a biological agent) and medical directors were analyzed qualitatively based on their written responses.

The median number of staffed beds was computed in each category (“yes, implemented” vs. “no, not yet implemented”). The significance of the difference in number of staffed beds was tested using a Mann-Whitney statistical process to test the rank sums. The assumption of equally shaped distribution curves was tested using the K-S test. Statistical processing of the data was done using Statistical Products and Service Solutions (SPSS) Statistical Software [12.0] (2003, SPSS Inc., Chicago, IL)

Using a series of bivariate comparisons, the question of whether the preparedness variables differed by location,

allocation of funds, size, trauma certification level, and/or whether they were in a network with other hospitals or a member of a single hospital system was examined. Cross-tabulation tables were created to yield the number and percent responding “yes” in these categories. Differences were tested using the chi-square statistic. Only those differences with a *p*-value of  $\geq 0.05$  are described in the results.

This was an observational study of a convenience sample in which trends were observed, rather than testing hypotheses. The sample size was small ( $n = 111$ ), thereby reducing the likelihood that there was sufficient power to detect differences in reported preparedness by categories (such as urban vs. non-urban, and in a network/system vs. single hospital). This lack of power does not affect findings

regarding differences in preparedness but, instead, increases the possibility that significant differences might be missed (i.e., false negatives, or type-II error).

## Results

Respondents consisted of 111 hospitals (both urban and non-urban) located mainly in the northeast corridor of the US.

This study addresses the assessment tool results according to the current (2004) HRSA benchmarks for funding. These benchmarks included: (1) education; (2) training and drills; (3) surge capacity; (4) communication systems; (5) regional integration; and (6) whether these activities had been tested (through drills).<sup>6,7</sup> In order to inform the content and format of future questionnaires, this study also explored the relationships between preparedness activities and the following hospital characteristics: (1) urban (i.e., in a Metropolitan Statistical Area (MSA), a freestanding metropolitan area of 50,000 to one million people) vs. non-urban (i.e., not in a MSA) status; (2) allocation of funds; (3) size (i.e., bed number); (4) hospital type; (5) trauma certification level; and/or (6) if the hospital is in a network or system with other hospitals.

While this assessment tool was tested on a convenience sample, the data collected provide information about the components of preparedness by the respondents, and suggest areas for exploration in the design of future hospital bioterrorism preparedness questionnaires.

Preparedness activities are reported and the differences in preparedness by certain hospital characteristics, including urban vs. non-urban, allocation of funds, size (i.e., bed number), and/or in a network or system with other hospitals are provided.

### *Hospital characteristics*

The characteristics of the 111 hospitals from eight states (Pennsylvania, Massachusetts, New Jersey, Michigan, Delaware, Colorado, Rhode Island, and Hawaii) that responded to the pilot assessment tool are listed in Table 2. The majority (88%) were located in a MSA and were medium-sized (i.e., 100–300 beds) (58%). Most (82%) were general medical and surgical hospitals. Four hospitals (all with  $\leq 25$  beds) were designated as a CAH. Ten percent were non-urban, and 15% were sole community hospitals. Thirty-five percent were networked with other hospitals or were a member of a single hospital system. Almost half (45%) of the hospitals reported trauma certifications. Level-II was the most common certification (19%).

### *Preparedness Activities*

**Administrative Actions**—Approximately half (47%) of the respondents had allocated funds for bioterrorism preparedness (Figure 1). More (60%) of the hospitals that were in a network with other hospitals or a member of a single hospital system had funds allocated for preparedness. Funding allocation was more common among larger than smaller hospitals (median beds = 263 vs. 196).

Most hospitals reported having a written bioterrorism response plan, medical director assigned to bioterrorism preparedness, and a formalized relationship with subject matter experts (91%, 79%, and 94% respectively).

Approximately half reviewed and updated their plan at least every two years (53%) and ensured that their plan addressed a scenario in which their hospital was a target of a bio-event (44%).

All but three hospitals (97%) had designated a bio-event coordinator (Figure 1). Educational qualifications of the coordinators (categories not mutually exclusive) included: (1) medical doctors (8%); (2) nursing (20%); and (3) masters' degrees (10%). Background experience and/or certifications included: (1) military (14%); (2) firefighting, paramedic, or rescue (10%); (3) safety (22%); (4) infection control (13%); (5) biological/chemical hazards (10%); (6) disaster planning (7%); and (7) weapons of mass destruction (5%). Five of the bio-event coordinators served more than one hospital. Stated differently, 14 of the hospitals shared a bio-event coordinator with another respondent hospital.

As for medical directors, 62% were board-certified in (or had experience in) emergency medicine or trauma, 14% had infectious disease expertise, and 7% had prior military experience. Like bio-event coordinators, several medical directors served more than one hospital. Fifteen hospitals shared a medical director with another respondent hospital.

**Education, Training, and Drills (Figure 2)**—More than half (57%) of the responding hospitals reported that non-clinical staff received training on bio-event preparedness, and 60% provided new employee instruction on bio-event preparedness as part of their orientation. Seventy-eight percent of the hospitals reported that staff participated in bio-event exercises at least every two years. Hospitals with more beds (median = 239 beds) were slightly more likely to have infection control practitioners trained on the local bio-event plan than smaller hospitals (median = 192 beds).

Hospitals that were in a network with others, or a member of a single hospital system, met training, education, and drill goals more often than did those that were not (Table 2). For all six questions focusing on training and education, more hospitals that were in a network or system reported successfully meeting goals. In four questions, the differences were statistically significant. One of the most important goals was participation in bio-event exercises every two years. Most (78%) hospitals did participate. However, among hospitals that were in a network or system, almost all (92%) had participated.

Another important goal was to provide clinical staff training at least every other year on the recognition, identification, and/or management of patients exposed to biological agents. Overall, 72% met this goal but more (87%) hospitals in a network or system achieved training goals (Table 3). Sixty-nine percent of respondents reported that their infection control practitioner received training on the local and/or state bio-event response plan; this often was more true among hospitals in a network or system (87%). Hospitals in a network or system (64%) were more likely to test their plans than were those outside (46%).

### *Surge Capacity (Figure 3a–3c)*

**Beds**—Half of the respondents had policies and procedures in place to increase inpatient bed capacity, while 59% had

Actions	Reporting yes, done or implemented	
	n	%
Administrative actions		
Funds allocated to support bio-preparedness (planning and training)	46	46.9
Medical Director for bio-preparedness	81	78.6
Emergency Plan addresses bio-preparedness	101	91.0
Ready access to Subject Matter Expert	100	93.4
Designated bio-event coordinator	95	96.9
Education, training, and drills		
Staff participate in bio-event exercises every two years	87	78.4
Non-clinical staff trained and tested on bio-event plan at least every two years	59	57.3
All new employees given instruction on preparedness	58	59.8
Infection control practitioner trained in state and local bio-event response plan (n = 108)	75	69.4
Clinical staff receives training on recognition and management of bio-patients at least every two years	73	72.3
Hospital staff trained and tested in bio-events	46	46.0
Surge capacity		
Beds, personnel, and decontamination:		
Procedures for increasing inpatient bed capacity	48	48.0
Expansion of outpatient capacity to serve ambulatory patients	63	58.9
Policy for emergency credentialing healthcare personnel	72	67.9
Provisions for converting space to temporary treatment/holding areas	74	69.2
Capacity to provide victim decontamination	91	90.1
Isolation and personal protective equipment		
Procedures for shutting down HVAC for individual departments	90	84.1
Procedures for infection control	95	89.6
Negative pressure isolation rooms	98	94.2
Pharmaceuticals, supplies, and equipment		
Providers to distribute medications to patients, staff, and families	38	36.5
Procedures for expanding storage capacities for additional supplies	54	49.5
Medications cache for patients, staff, and families	63	56.8
Plan to obtain additional supplies	78	77.2
Plan to obtain additional pharmaceuticals	84	77.8
Staff support		
Provisions for housing personnel during bio-event	58	55.2
Plan to support physical needs (food, rest area) of staff during bio-event	85	78.7
Mental health support available to staff and victims	88	82.2
Communication Systems		
Rapidly post public health alerts (e.g., from CDC)	95	88.8
Emergency department access to Internet	102	94.4
Information system dedicated to staff information/inquiries	78	70.3
Plan designates media spokesperson	96	89.7
Integration with local or regional systems		
Hospital roles/responsibilities defined by community emergency management or public health officials	84	77.1
Hospital represented in external task forces (i.e., public health department) or other groups responsible for regional bio-event preparedness	110	100.0
Hospital participates in regional system to monitor inpatient bed availability monitored in real time	49	46.2
Hospital participates in regional system to monitor emergency department diversion status in real time	68	65.4
Hospital participates in regional planning for mass prophylaxis, vaccination, and treatment	53	50.0
Protocols/MOU to transfer bio-patients	56	56.0
Participate in regional surveillance system for early identification of new, emerging infections	73	70.2

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**Table 2**—Preparedness activities (CDC = Centers for Disease Control and Prevention; HVAC = heating, ventilation, air conditioning; MOU = memoranda of understanding)

In-Hospital Network or System (n = 111)				
Action	n	% No	% Yes	% Total
Staff participates in bio-event exercises every 2 years*	11	70.8	92.3	78.4
New employees given instruction on preparedness	97	58.1	62.9	59.8
Health staff receives training on recognition/management of bio-patients at least every 2 years**	101	64.6	86.6	72.3
Infection control practitioner trained on local/state bio-event response plan	108	59.4	57.2	69.1
Hospital staff trained and tested on bio-event plan*	100	35.9	63.9	46.0
Non-clinical staff receives training at least every 2 years	103	54.5	62.2	57.3

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**Table 3**—Staff education and training by facility membership in hospital network or system \* $p < 0.01$ ; \*\* $p < 0.05$  (n = number of hospitals answering each action question)

plans for expanding outpatient capacity to treat ambulatory patients. Specifically, 43% had policies and procedures to increase inpatient adult medical beds, 37% for adult surgical beds, 36% for adult critical care beds, 17% for pediatric medical beds, 11% for pediatric surgical beds, and 8% for pediatric critical care beds. However, the ability to expand inpatient capacity was tested by only 2–12%, with pediatric bed expansion being tested the least often. In addition, more than half (69%) had provisions for converting space into temporary treatment and holding areas. Interestingly, 91% of hospitals in non-urban areas and 83% of “sole community hospitals” reported being able to expand their outpatient capacity. Overall, only 31% of the respondents had tested this capacity.

**Personnel**—The majority (68%) reported that they had a policy for emergency provider credentialing and privileging (Figure 3). More than half (53%) had coordinated their ability to provide credentialing and privileging with community emergency management and/or health departments. In addition, almost all of the respondents (91%) reported that they had procedures in place to expand ancillary staff, including security, food service, laboratory, pharmacy, and housekeeping staff (Figure 4). Approximately three-quarters (76%) of responding hospitals had tested their ability to expand staff. However, 86% of respondents reported that they had tested their ability to expand emergency department staff.

Approximately half (55%) of the respondents reported provisions for housing personnel during a bio-event, and only 20% had tested this (Figure 4). The majority (79%) reported that they had plans to support other physical

needs such as food and rest areas. Furthermore, 82% reported that they could provide staff and/or victim mental health support 24 hours/day.

**Decontamination (Figure 3)**—Almost all of the respondents (90%) reported that they can provide victim decontamination, and the majority (70%) reported having their own decontamination capability.

**Isolation Rooms and Personal Protective Equipment**—Of the respondents, 84% had procedures in place for shutting down heating, ventilation, and air conditioning (HVAC) systems in individual departments. However, only 40% had tested such procedures. Almost all hospitals (90%) reported having procedures for infection control, but all hospitals in a network or system reported procedures for infection control. Almost all (91%) reported having personal protection equipment (PPE), such as respirators, for staff. In addition, almost all (94%) of respondents reported that they had negative-pressure, High Efficiency Particulate Air-filtered isolation rooms, with eight being the median number of available isolation rooms. However, only 14% had tested inpatient isolation procedures.

**Pharmaceuticals, Supplies, and Equipment**—More than half of the respondents (57%) reported that they had their own cache of medications for patients, staff, and families. This increased to 72% for hospitals in a network or system. The majority (77%) reported that they had plans for obtaining additional supplies in the instance of a bio-event, and the majority (78%) indicated that the plan includes obtaining additional pharmaceuticals. However, only 36% of respondents had procedures in place for distributing these medications and only 1% had tested such procedures. Half reported that they had procedures to expand storage capacities for additional supplies.

**Communication Systems (Figure 5)**—Overall, the majority of respondents (70%) had communication systems dedicated to staff information and inquiries. Hospitals with this capability were slightly larger than those without (median beds = 213 vs. 180). Of hospitals in a network or system, 87% had a system dedicated to staff information and inquiries.

The vast majority of respondents (89%) reported that their hospitals had a method for rapidly posting public health alerts (such as those from the Centers for Disease Control and Prevention (CDC) and local health departments). Almost all of the hospitals (90%) had designated a media spokesperson.

Most respondents (94%) reported that their hospitals had emergency department access to the Internet, but this was slightly more often the case for larger hospitals (median bed size 212 vs. 120). All hospitals with  $\geq 300$  beds had Internet access in their emergency departments.

**Integration with Local or Regional Systems (Figure 6)**—Overall, less than half of the respondents (46%) reported monitoring regional bed availability in real-time. However,

in hospitals with  $\geq 300$  staffed beds, this number decreased to only 23%.

Half of the respondents participated in regional planning for mass prophylaxis, vaccination, and/or treatment. Furthermore, 75% of hospitals characterized as "sole community hospitals" participated in such planning.

Over half (56%) of the respondents reported that their hospitals had memoranda of understanding (MOU) or protocols with other healthcare facilities for the transfer of patients.

The majority of respondents (70%) reported that they participate in regional surveillance systems for early identification of new emerging infections. However, less than half (46%) of hospitals outside of a MSA reported participation in such regional surveillance systems. In addition, the majority (65%) reported that they participate in real-time monitoring of regional emergency department diversion status.

Some aspects of local or regional integration were associated with hospital size or location. Specifically, 77% of the respondents reported that community emergency management or public health officials had defined the roles and responsibilities of their hospitals. However, the hospitals with  $\geq 300$  beds had defined roles and responsibilities. Conversely, monitoring regional inpatient bed availability was less common in larger hospitals.

Similarly, the majority of the respondents (68%) reported that they participated in a regional system to monitor emergency department diversion status in real-time. This also appeared to differ by urban status. Only one-third (36%) of the hospitals outside of a MSA reported participating in a regional system to monitor emergency department status.

All respondents reported that their hospitals were represented in external task forces (such as those assembled by a public health department or another agency responsible for regional planning).

## Discussion

All but three of the respondent hospitals had a designated bio-event coordinator and the vast majority assigned a medical director, which might explain their ability to develop or update their bioterrorism response plans. The majority of these hospitals implemented these plans, including providing bioterrorism preparedness training to new employees (including ancillary staff), and training clinical staff on the recognition, identification, and/or management of persons exposed to bioterrorism agents. Furthermore, the majority of these hospitals participated in bio-event drills and updated their emergency management plans according to lessons learned.

Another encouraging finding is that the majority of hospitals not only had developed plans to temporarily expand staff (including emergency department clinicians and ancillary staff), but also had tested them. The majority of respondent hospitals also reported that they could provide food and rest areas to accommodate surges in staff demand and longer work shifts (both anticipated during a prolonged bioterrorism response). In addition, the majority reported that they could decontaminate victims and isolate infectious cases, thereby protecting other patients and staff. Also, the majority reported that infection control procedures and PPE were available for patient and staff protec-

tion. Many of the hospitals that did not report capabilities in these areas, indicated that they were planning improvements within the next six months.

Another interesting finding is that hospitals that are in a network with other hospitals or that are a member of a single hospital system may have economies of scale. For example, 14 of the 39 hospitals in a network or system shared a bio-event coordinator and 15 shared a medical director with other hospital(s) who also responded to the questionnaire. The hospitals in a network or system also may have shared these positions with non-respondent hospitals as well. For example, some bio-event coordinators may have conducted similar training in more than one hospital. The results of this study are consistent with this interpretation since hospitals in a network or system reported higher levels of preparedness for four of the six education and training questions. Hospitals in a network or system, like larger hospitals, also were more likely to have had funds allocated for bioterrorism preparedness.

## Needed Improvements

Overall, temporary housing for expanded staff and their families was lacking. In addition, although the vast majority of hospitals reported that plans had been established to obtain expanded numbers of ancillary staff to augment or relieve existing staff, more efficient mechanisms for credentialing providers must be developed and tested prior to a bio-event. Although the majority of hospitals reported access to additional pharmaceuticals, supplies, and equipment, reception and distribution policies must be developed and tested. Furthermore, real-time communication capabilities with local and state agencies were not uniformly in place and, if they were, they had not been tested. The results of this study suggest that participation in emergency department diversion status also must be improved, particularly for non-urban hospitals.

Hospitals outside of a MSA were less likely to participate in regional surveillance systems for the early identification of newly emerging infections. This might weaken the ability of their region to detect and rapidly contain an infectious disease outbreak. The results of this study suggest that further efforts are needed to improve regional disease surveillance in non-urban areas.

Although these results suggest that overall, larger hospitals are better prepared overall, it is puzzling that they were less likely to participate in systems to monitor regional inpatient bed availability in real-time. It may be that they have less need to transfer patients elsewhere. However, this need might arise during a response to a large-scale bio-event.

One of the positive lessons learned following the 2001 terrorist attack on the Pentagon is that effective communication from hospitals in Northern Virginia to a regional burn center in Washington, DC allowed for a rapid transfer of burn victims, and likely saved lives.<sup>10</sup> The results of this study suggest that regional coordination activities among hospitals and external response agencies are underway, but activities such as monitoring regional bed availability in real-time must be improved. Further efforts should include regional drills that impose realistic time constraints, involve very large numbers of patients, and evaluate communication systems and coordination efforts

among first responders, local and state agencies, and hospitals.

While not representative of US hospitals, this study included important hospital bioterrorism preparedness topics excluded from previous studies, and included both urban and non-urban hospitals. Although the findings are encouraging, results from this pilot study suggest that further assessment tools (with representative samples) should be directed particularly to capacities and challenges among hospitals that are non-urban and/or smaller.

Hospitals working independently to prepare for a massive influx of infectious, exposed, injured, or otherwise concerned patients likely will not be sufficient. Future studies also are needed to determine and describe if and how hospitals' membership in a network or system and other regional cooperative planning initiatives among healthcare organizations, are associated with higher levels of preparedness. Meanwhile, hospitals should consider developing or strengthening alliances with other hospitals so as to share plans and resources that promote bio-event preparedness.

#### Limitations

Due to data limitations (specifically, no denominator data), it is impossible to conclude that differences do not exist if they cannot be found. Differences found in this study are likely to be valid. In addition, the authors can be more confident about differences found that they are consistent with theory (e.g., a previous report that non-urban hospitals have more limited communication capabilities and participate less in regional disease surveillance systems), or when they fit into a pattern of responses (e.g., in this assessment tool, hospitals in a network or system reported higher preparedness in four out of six assessment tool questions relating to education and training).

Since the AHRQ-HRSA did not randomly select hospitals, they may not be representative of US hospitals in general. In fact, respondent hospitals were from only eight states, mostly in the northeast corridor of the US, and were predominantly urban. In addition, because almost all respondent hospitals reported having taken certain steps in

preparedness (such as designating a bio-event coordinator and implementing various plans), they might not represent the preparedness level of all hospitals.

Reporting bias may have occurred in this self-assessment questionnaire, particularly if the individual(s) completing the assessment tool erroneously surmised that their reporting (either under-reporting or over-reporting a preparedness level) might influence funding.

Finally, the variable "in a network or system" was derived from hospital Websites; if information was not available on the Website, but a hospital was in a network or system, it might have been determined erroneously that it was not.

#### Conclusions

The AHRQ-HRSA currently is using the results from the use of this pilot assessment tool to define and benchmark regional, healthcare, system bioterrorism readiness, identify promising (best) practices in surge capacity planning, and to develop regional planning documents with specific checklists designed for hospitals, public health, and community response agencies. More importantly, AHRQ-HRSA has convened an expert panel to expand the preparedness questionnaire to include "all hazards"—chemical, biological, radiation, nuclear, and explosive (CBRNE) events. The expanded AHRQ-HRSA CBRNE Emergency Planning and Preparedness Questionnaire for Healthcare Facilities will elicit pertinent information from all HRSA-funded hospitals in all 50 states. This tool will be useful to these hospitals as a means of assessing their current "all-hazards" readiness and, using the same questionnaire, monitoring their progress. The use of response categories also will help in determining whether specific plans have been tested in a drill or in response to an actual event. Results of this more extensively distributed questionnaire likely will yield more definitive conclusions about hospital preparedness, and continue to assist federal funding initiatives.

The results of this study should be useful to federal funding agencies, local and state planners, hospitals, and hospital networks, as they craft definitive assessment tools to identify trends and further establish benchmarks.

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