Annals of Internal Medicine | ARTICLE

Integrating Hospitals into Community Emergency Preparedness Planning

Barbara I. Braun, PhD; Nicole V. Wineman, MA, MPH, MBA; Nicole L. Finn, MA; Joseph A. Barbera, MD; Stephen P. Schmaltz, PhD; and Jerod M. Loeb, PhD

Background: Strong community linkages are essential to a health care organization's overall preparedness for emergencies.

Objective: To assess community emergency preparedness linkages among hospitals, public health officials, and first responders and to investigate the influence of community hazards, previous preparation for an event requiring national security oversight, and experience responding to actual disasters.

Design: With expert advice from an advisory panel, a mailed questionnaire was used to assess linkage issues related to training and drills, equipment, surveillance, laboratory testing, surge capacity, incident management, and communication.

Setting: A simple random sample of 1750 U.S. medical–surgical hospitals.

Participants: Of 678 hospital representatives that agreed to participate, 575 (33%) completed the questionnaire in early 2004. Respondents were hospital personnel responsible for environmental safety, emergency management, infection control, administration, emergency services, and security.

Measurements: Prevalence and breadth of participation in community-wide planning; examination of 17 basic elements in a weighted analysis.

Results: In a weighted analysis, most hospitals (88.2% [95% CI, 84.1% to 92.3%]) engaged in community-wide drills and exercises, and most (82.2% [CI, 77.8% to 86.5%]) conducted a collaborative threat and vulnerability analysis with community responders. Of all respondents, 57.3% (CI, 52.1% to 62.5%) reported that their community plans addressed the hospital's need for additional supplies and equipment, and 73.0% (CI, 68.1% to 77.9%) reported that decontamination capacity needs were addressed. Fewer reported a direct link to the Health Alert Network (54.4% [CI, 49.3% to 59.5%]) and around-the-clock access to a live voice from a public health department (40.0% [CI, 35.0% to 45.0%]). Performance on many of 17 basic elements was better in large and urban hospitals and was associated with a high number of perceived hazards, previous national security event preparation, and experience in actual response.

Limitations: Responses reflect hospitals' self-perception of linkages. The quality of linkages and the extent of possible biases favoring positive responses were not assessed.

Conclusions: In this baseline assessment, most hospitals reported substantial integration. However, results suggest that relationships between hospitals, public health departments, and other critical response entities are not adequately robust. Suggestions for enhancing linkages are discussed.

Ann Intern Med. 2006;144:799-811. www.annals.org
For author affiliations, see end of text.

Hospital personnel play an important role in disaster response. Their roles vary according to the type of disaster, location, and availability of local resources and can include bioterrorism incident identification, triage and treatment of victims, and promoting accurate and consistent public information. The effectiveness of hospital staff response is greatly enhanced by preevent integration into the community emergency preparedness and response planning process (1). The hospital that establishes linkages clarifies its role and promotes interaction between essential personnel and available community resources that can enhance hospital surge capacity.

Recent reports have expressed concern that hospitals are not adequately integrated into community planning. Hospitals are said to be isolated in their planning activities and are possibly the weakest link in emergency response (2–5). To better understand the extent to which hospitals are integrated into community planning, we assessed hospital and community linkages. We also examined the hypotheses that better linkages would be associated with hospitals that perceived themselves to be at risk for a high number of hazards or threats, those located in a community that had experienced an actual disaster, and those that had previously prepared for a major event that required national security oversight (Appendix, available at www.annals.org).

During the first 72 hours of a disaster, local agencies are generally the first to respond (6); first responders are often members of the affected community (1, 7). Community preparedness is a complex concept that requires a system-level response because multiple stakeholders are involved and many potential hazards exist. A well-prepared community will have a comprehensive planning process, a thorough emergency operations plan, established response capability, and an ongoing surveillance and notification

See also:

Print
Editors' Notes 800

Web-Only
Appendix
Appendix Tables
Conversion of figures and tables into slides

Context

Recent natural disasters and terrorist attacks have underscored the necessity for health care facilities to integrate their activities with other community response teams.

Contribution

The investigators developed and administered a nationwide survey questionnaire to assess the existence and character of hospital–community services linkages that facilitated the response to local emergencies. Most responding hospitals conducted community drills; analyzed threat vulnerability; and planned for additional supplies, equipment, and decontamination facilities. Other linkages were less widespread.

Cautions

Hospital response rate to questionnaires was low, and answers were unverified.

Implications

Effective coordination of effort requires development of national standards for community preparedness.

—The Editors

system for identifying and communicating emergencies. These 4 domains form the conceptual framework for this study (**Figure 1**), which assessed emergency preparedness and response planning linkages between hospitals and community stakeholders in a national random sample of hospitals.

METHODS

The study methods comprised the following: convening a technical expert panel, developing questions for the survey instrument, developing a hospital sampling strategy, administering the survey instrument and collecting data, and analyzing and interpreting of the results. The Joint Commission on Accreditation of Healthcare Organizations' (hereafter referred to as the Joint Commission) external institutional review board approved the study. To maintain promised confidentiality, no identifiable hospital names or locations were reported.

Questionnaire Development

The technical expert panel included 12 members with experience across a range of relevant disciplines; the panel comprised a balance of practicing clinicians, academic researchers, and agency emergency preparedness experts. The panel met 4 times, in person and by conference call, to identify topic areas and issues and to review draft questions and pilot results. Following an in-person panel meeting and detailed literature search, the project team drafted a pilot questionnaire that was tested in 9 hospitals. The final version contained 57 items across several topic areas (**Table 1**). Because the questionnaire was administered before the National Incident Management System was published, it was not entirely consistent with the system's language (Appendix, available at www.annals.org).

Sample and Implementation Strategy

A simple random sample of 1750 hospitals was drawn from the population of all U.S. general medical–surgical hospitals in the 2003 American Hospital Association database (8) ($n = 4863$). A 2-phased implementation strategy was used. First, the president of the Joint Commission and the study's principal investigator cosigned invitation letters that were mailed to the chief executive officers of all hospitals in the sample in late January 2004. The invitation letters indicated that participation in the research was entirely voluntary, anonymous, and unrelated to accreditation. In addition, the Joint Commission, the National Rural Health Association, and the American Hospital Association sent listserv messages announcing the project. In the second phase, chief executive officers who replied positively to the invitation provided the name and title of the contact person most familiar with emergency preparedness at their hospital. The questionnaires were mailed to the designated contact person in February 2004. Over the next 8 weeks, nonrespondents received a reminder postcard, personal telephone calls, and a final e-mail message to encourage completion of the questionnaire. Incoming questionnaires were examined for missing or inconsistent information; requests for clarification were sent by e-mail to the contact person.

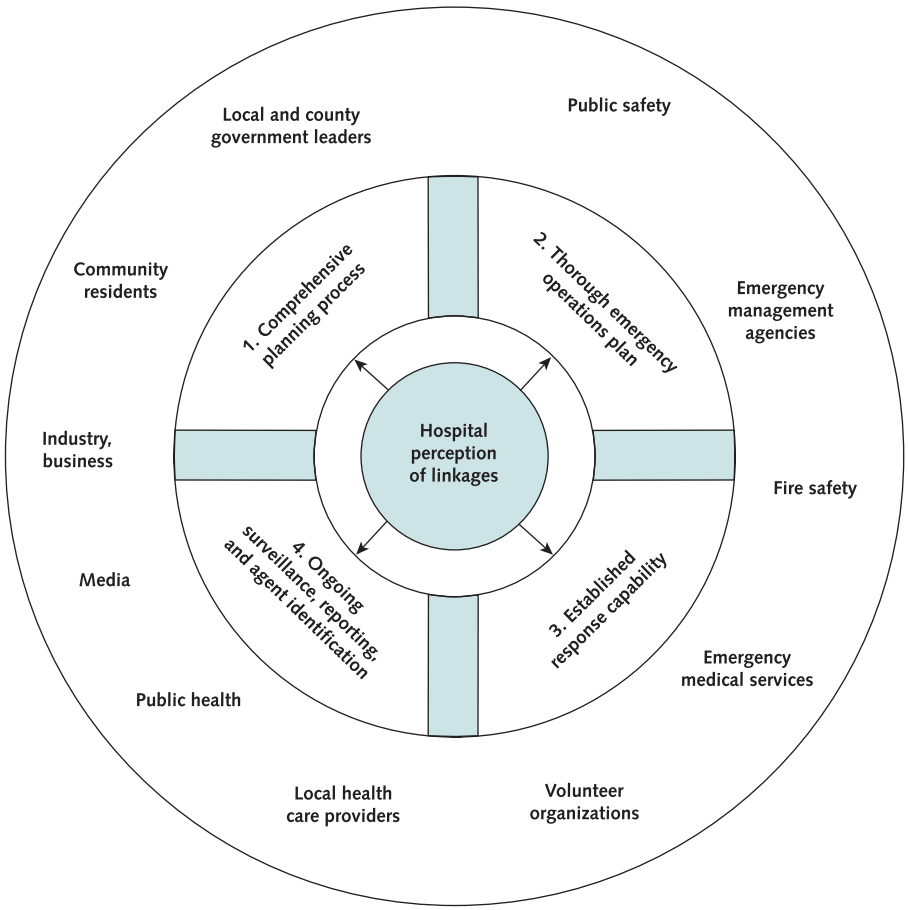
Statistical Analysis

Because no widely accepted, predefined model or requirements for linkages existed, we attempted to determine which questionnaire items were most important. The technical expert panel collaborated with the study team during fall 2004 to identify 17 questionnaire items (one of which comprised 6 subitems) that represented minimum basic elements of effective community linkages; these elements were chosen on the basis of face validity, expert opinion, and published literature.

To assess reliability, we measured the consistency of an individual's response over time to 3 questionnaire items of varying complexity in a random sample of 52 hospitals. Respondents were contacted by e-mail and were asked to complete 3 follow-up questionnaire items that corresponded with items in the original questionnaire. We calculated the agreement between follow-up items and original responses. Agreement was defined as 2 "yes" responses or 2 "no" or "don't know" responses for each hospital and question over time. In addition, the accuracy of data entry was assessed by calculating agreement from duplicate entry of 12 randomly selected questionnaires.

Three demographic factors were used to define groups for comparison: the hospital's average daily census, whether the hospital was located in a Metropolitan Statistical Area (Appendix, available at www.annals.org) or in a rural area, and the duration of the hospital's involvement

Figure 1. **Domains and stakeholders for assessing community emergency preparedness and response linkages.**



in community emergency preparedness planning. We also defined groups by 3 risk and experience factors: perceived risk of 6 or more hazards or threats, previous preparation for an event requiring national security oversight, and experience responding to a public health emergency or actual disaster in the community.

We used SAS statistical software, version 9.1 (SAS Institute, Cary, North Carolina) for all analyses. For analysis of the 17 basic elements, sampling weights were used to adjust the results for nonresponse (9). To determine the weights, we used logistic regression to estimate the probability that a sampled hospital had completed the survey as a function of bed capacity, accreditation status, location (urban or rural), and region. The estimated response probabilities from this regression were then grouped into 12 weighted adjustment classes so that the number of responses within each class was at least 20 and the units within each class were as similar as possible, based on the estimated probabilities. The inverse of the average predicted probability of response within each weighted adjustment class was then used as the weight. The means and 95% CIs for each of the 17 basic elements, both overall and stratified by the demographic characteristics, were then calculated by using these sampling weights. The association of the basic elements with each of the demographic characteristics was determined by using weighted chi-square tests (in these weighted analyses, PROC SURVEYFREQ and PROC SURVEY MEANS statements were used). A 2-tailed P value of less than 0.05 indicated statistical significance. When interpreting the results, the reader should use caution because the analyses were not adjusted for multiple comparisons. For each of 6 demographic and experience factors, 23 comparisons were made (138 total com-

Table 1. **Topics Addressed in the Questionnaire**

Hospital and community planning
Community-wide training and drills
Community plans for additional supplies and equipment
Systems for public health reporting and laboratory capacity
Community surge capacity plans relating to staffing, transportation, and sharing information about available resources
Incident management
Communication mechanisms and protocols

Table 2. **Characteristics of Hospitals in the Population and Sample**

Characteristic	All Hospitals, *n**	Hospitals Invited, *n (%)*	*P* Value†	Responding Invitees, *n (%)*	*P* Value‡
Location			0.29		<0.001
Urban	2574	944 (36.7)		355 (37.6)	
Rural	2289	806 (35.2)		220 (27.3)	
Region			0.56		<0.001
East North Central	728	258 (35.4)		109 (42.2)	
East South Central	425	155 (36.5)		48 (31.0)	
Mid Atlantic	463	179 (38.7)		75 (41.9)	
Mountain	369	121 (34.4)		39 (32.2)	
New England	192	66 (34.4)		20 (30.3)	
Pacific	574	224 (39.0)		58 (25.9)	
South Atlantic	735	266 (36.2)		97 (36.5)	
West North Central	692	236 (34.1)		54 (22.9)	
West South Central	685	245 (35.8)		75 (30.6)	
Bed capacity			0.78		<0.001
6–50	1235	436 (35.3)		87 (20.0)	
51–113	1205	448 (37.2)		142 (31.7)	
114–228	1211	431 (35.6)		136 (31.6)	
≥229	1212	435 (35.9)		210 (48.3)	
Accredited			0.29		<0.001
No	1117	417 (37.3)		45 (10.8)	
Yes	3746	1333 (35.6)		530 (39.8)	

* Defined as medical–surgical hospitals in American Hospital database in 2003.
† *P* value for chi-square test of proportion of population invited.
‡ *P* value refers to the distribution of response rates.

parisons). Therefore, approximately 7 comparisons were expected to be significant by chance. The number of missing responses is reported in the text whenever 10 or more responses were missing.

Role of the Funding Source

The funding source (Agency for Healthcare Research and Quality) was represented by a project officer on the expert panel but had no influence over the design, conduct, and analysis of the study or the decision to submit the manuscript for publication.

RESULTS

Of the 1750 hospitals that were invited, 678 (39%) chief executive officers responded positively to the letter of invitation. Forty hospitals (2%) declined to participate, 1019 (58%) did not respond to the letter, and 13 questionnaires (<1%) were returned as undeliverable. Of the 678 hospitals that received questionnaires, 575 (85%) were completed. One or more hospitals from 48 states and the District of Columbia responded (no response was received from hospitals in Delaware and Vermont).

When we compared hospitals in the random sample with general medical–surgical hospitals throughout the United States, we found no significant differences in number of beds ($P = 0.78$), urban or rural location ($P = 0.29$), region ($P = 0.56$), or accreditation status ($P = 0.29$). Among those invited, there were significant differences in the rate of completed questionnaires by demographic category (**Table 2**). Significantly lower response rates were found among hospitals that were located in rural areas, had fewer beds, were not accredited, and were located in the West North Central region of the country ($P < 0.001$ for all variables).

Among responding hospitals, slightly more than half were located in urban areas. The median average daily census across participating hospitals was 87 (interquartile range, 26 to 193). Thirty-five percent were trauma centers. The median number of emergency department visits per day was 70 (interquartile range, 36 to 113). Most (71%) had received $50 000 or less in federal or state funding for preparedness activities in 2003, and 12% received between $50 001 and $200 000; 15% received no funding ($n = 516$; data missing for 59).

Hospital chief executive officers designated staff members from a wide range of departments as the hospital's primary contact person. Most frequently cited were security (24%), emergency services (17%), administration (13%), emergency management (12%), and facility operations or environmental services (10%). Of these personnel, 19% held positions classified as senior leadership (officer, administrator, or vice president). The median number of staff contributing to the survey per hospital was 4 (interquartile range, 3 to 6). The median time reported to complete the questionnaire was 120 minutes (interquartile range, 90 to 240 minutes).

Regarding the reliability of responses, the consistency

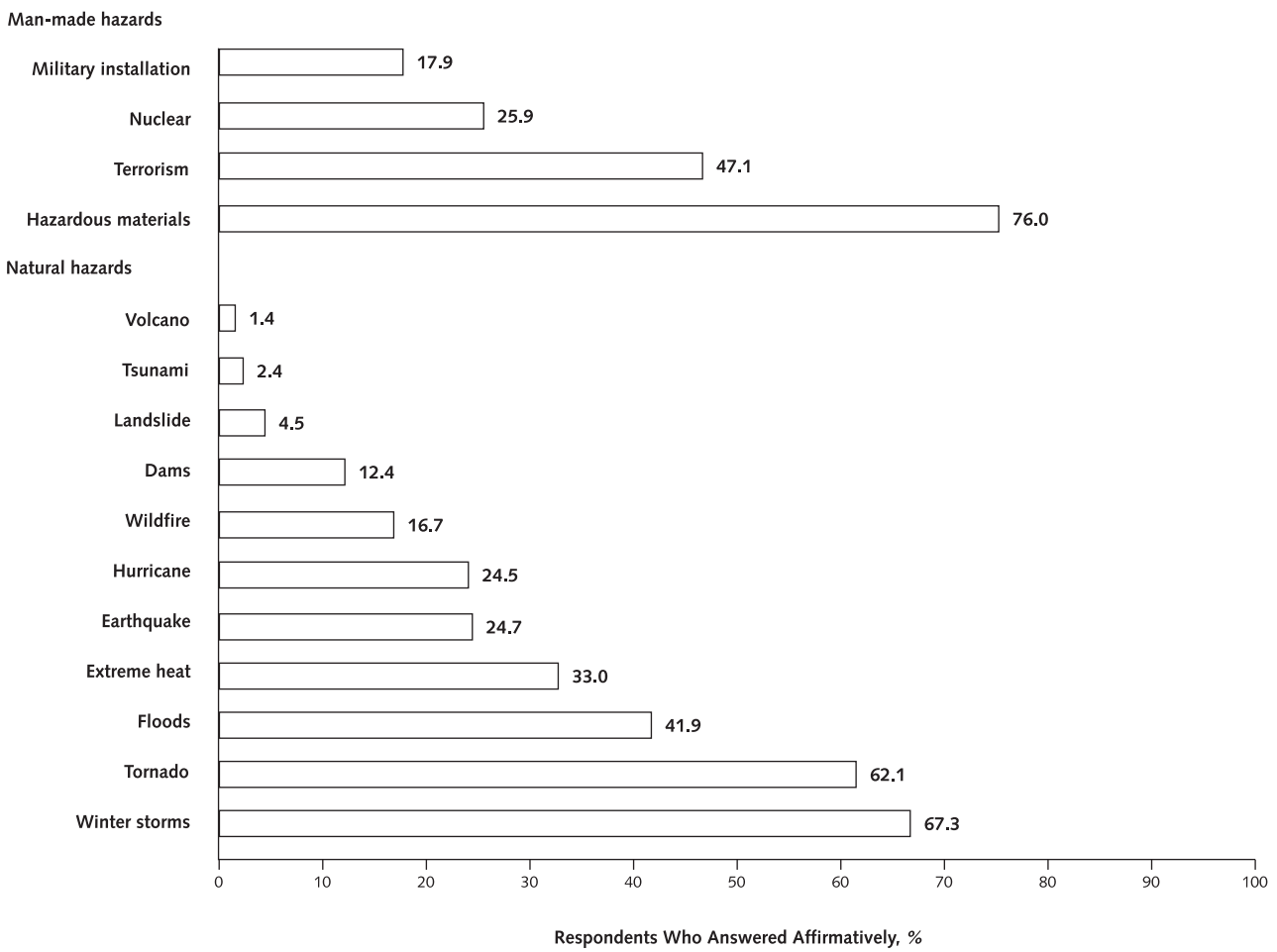
corresponded with the item's complexity; 71% agreed on the ability to request and receive laboratory testing of suspected Centers for Disease Control and Prevention category A agents on an around-the-clock basis, 87% agreed on the triage strategy addressed in the community plan, and 79% agreed on hospital involvement in community exercising of the Strategic National Stockpile (SNS) (Appendix, available at www.annals.org). A total of 49 data entry discrepancies were found among 9408 opportunities for error (784 data points multiplied by 12 questionnaires), yielding an overall rate of agreement of greater than 99%.

Community Planning Process, Emergency Operations Plan, and Experience Factors

All simple percentages reported before the results of the basic elements of linkages represent unweighted estimates. **Appendix Tables 1**, **2**, and **3**, which present unweighted estimates, are available at www.annals.org. Nearly all responding hospitals reported that their community had a group or committee that was responsible for emergency preparedness planning and response activities. The median number of community entities represented in the groups was 11 (interquartile range, 9 to 13). Most community groups included representation from traditional emergency responders, but few included members from industry or manufacturing, local media, or professional groups. The median number of times per year the community planning group reportedly met in person was 6 (interquartile range, 4 to 12). Of all respondents, 75% reported that the community also had a coalition of health care organizations that coordinated health care emergency planning and response.

Most hospitals reported that their involvement in community planning predated 2001; 27% of respondents reported involvement before 1990. Most (86%) reported that they had conducted a threat and vulnerability analysis in conjunction with other community responders. The

Figure 2. **Frequency of perceived community hazards or threats.**



Frequency calculated on the basis of unweighted analysis of 575 responses to the question, "Do you perceive your hospital to be at increased risk for any of the following hazards or threats (check all that apply)?"

Table 3. **Weighted Prevalence of Basic Elements and Association with Hospital Characteristics***

Basic Element	Hospitals Answering Affirmatively (95% CI), %	Location (95% CI), %		
		Urban	Rural	*P* Value
Collaborative planning process				
Collaborative threat and vulnerability analysis of community has been completed	82.2 (77.8–86.5)	86.0 (81.2–90.7)	77.4 (69.7–85.1)	0.008
Existing health care coalition	67.7 (63.5–74.0)	84.5 (79.4–89.7)	49.3 (40.7–57.9)	<0.001
Community has a crisis communication protocol	69.4 (64.4–74.4)	73.5 (67.5–79.6)	64.3 (56.0–72.7)	0.017
Community emergency operations plan				
Community has a plan that addresses the hospital's need for additional supplies in the event of an emergency	57.3 (52.1–62.5)	64.8 (58.9–70.8)	48.0 (39.4–56.5)	<0.001
Community has a mechanism for credentialing staff during an emergency	76.5 (70.7–82.3.)	66.3 (60.2–72.5)	58.7 (50.1–67.2)	NS
Community plan addresses the hospital's ability to expand capacity for decontamination	73.0 (68.1–77.9)	76.5 (69.8–80.6)	68.7 (60.5–77.0)	0.037
Community plan addresses use of alternate sites of nonacute care	75.8 (71.5–80.0)	72.9 (67.4–78.3)	79.4 (72.7–86.1)	NS
Community plan addresses provisions for additional morgue space	69.4 (64.4–74.4)	75.6 (69.7–81.4)	61.8 (53.3–70.3)	<0.001
Community plan has a mechanism for tracking patient location	46.2 (41.1–51.3)	52.2 (45.9–58.5)	38.8 (30.5–47.2)	0.001
Community has a plan to manage a large volume of calls regarding affected persons	32.6 (27.9–37.3)	38.7 (32.7–44.6)	25.2 (17.9–32.6)	<0.001
Established response capability				
Hospital has participated in at least 3 community-wide trainings on emergency preparedness and response	40.2 (35.3–45.1)	50.8 (44.6–57.1)	27.1 (19.9–34.3)	<0.001
Hospital has participated in a community-wide emergency or disaster drill or exercise	88.2 (84.1–92.3)	91.5 (86.8–96.2)	84.2 (77.1–91.2)	0.007
Hospital shares information on the following areas				
Emergency department capacity	84.7 (80.5–89.0)	92.8 (89.3–96.3)	74.9 (66.8–82.9)	<0.001
Inpatient bed capacity	83.7 (79.3–88.1)	94.6 (92.2–97.1)	70.4 (61.9–78.9)	<0.001
Intensive care unit bed capacity	74.2 (69.1–79.3)	86.0 (80.5–91.3)	59.8 (51.2–68.5)	<0.001
Negative pressure room availability	67.0 (62.0–72.1)	75.2 (69.8–80.6)	57.1 (48.5–65.7)	<0.001
Decontamination capacity	72.5 (67.6–77.3)	78.3 (72.7–83.8)	65.3 (57.0–73.7)	<0.001
Ventilator availability	63.1 (57.9–68.4)	69.8 (63.5–76.1)	55.0 (46.3–63.6)	<0.001
Hospital IMS was developed with the community emergency management agency	62.6 (57.5–67.7)	70.2 (64.3–76.1)	53.1 (44.6–61.8)	<0.001
Community IMS has an emergency operations center that has been tested through drills	77.5 (72.7–82.4)	83.4 (77.7–89.1)	70.2 (62.1–78.4)	<0.001
Ongoing surveillance, reporting, and laboratory identification				
Hospital has access to live answers from public health personnel around the clock	40.0 (35.0–45.0)	51.3 (44.9–57.6)	26.5 (19.2–33.8)	<0.001
Hospital has a direct electronic link to the state Health Alert Network	54.4 (49.3–59.5)	54.4 (48.2–60.6)	54.5 (45.9–63.0)	NS

* Estimates displayed are based on a weighted analysis that was conducted to approximate a nationally representative sample. IMS = incident management system; NS = not significant.

median number of perceived community hazards or threats was 5 (interquartile range, 3 to 6); hazardous materials, winter storms, and tornadoes were the most commonly reported perceived threats (**Figure 2**).

Most (86%) hospitals reported using an incident management system; 65% of hospitals reported that their incident management system was developed collaboratively with the local emergency management agency. Nearly three quarters (73%) of the hospitals reported that their communities had crisis communication protocols, and 41% reported being involved in the protocol's development.

Almost all respondents reported that their community had an emergency operations plan that specifically addressed health and medical response. Reports of community plans to expand hospital capacity varied by topic area. More than three quarters of respondents reported that their community plans addressed immunization and prophylaxis for key personnel and the need to expand hospital decontamination capacity. However, only about one half of hospitals reported that the community plans addressed the need to expand hospital capacity to isolate people or support ventilator-dependent patients. Close to one half reported that the community plan addressed mechanisms for tracking patient location and managing a large volume of calls.

Most hospitals reported that their communities had identified nontraditional ways to transport victims to

Table 3—Continued

Average Daily Census (95% CI), %					Year Became Involved in Community Planning (95% CI), %			
1–49	50–99	100–299	≥300	*P* Value	1950–1989	1990–2000	2001–2004	*P* Value
75.4 (67.7–83.1)	89.1 (82.2–96.0)	87.1 (79.8–94.5)	88.7 (81.0–96.4)	0.001	76.9 (67.6–86.2)	87.2 (82.7–91.8)	80.1 (70.8–89.5)	0.020
51.8 (42.9–60.8)	74.4 (65.5–83.4)	85.1 (79.9–90.3)	96.5 (92.4–100)	<0.001	64.2 (54.1–74.3)	74.4 (67.5–81.4)	65.1 (54.3–75.9)	0.046
59.3 (50.5–68.0)	74.5 (64.2–84.7)	76.0 (69.0–83.1)	94.5 (89.0–100)	<0.001	68.0 (58.4–77.7)	80.3 (74.6–86.0)	55.2 (44.6–65.7)	<0.001
49.3 (40.5–58.1)	65.3 (54.6–76.1)	60.2 (52.2–68.1)	75.8 (65.3–86.3)	<0.001	57.9 (48.0–67.7)	62.4 (55.1–69.6)	49.4 (39.0–59.8)	0.033
55.9 (47.0–64.8)	66.4 (55.8–77.1)	70.2 (62.9–77.6)	70.0 (58.7–81.3)	0.012	65.0 (55.6–74.4)	66.3 (59.1–73.6)	55.9 (45.3–66.4)	NS
63.6 (54.9–72.4)	80.5 (72.4–88.5)	80.1 (73.3–87.0)	86.1 (77.8–94.4)	<0.001	71.2 (61.4–80.9)	78.0 (71.8–84.2)	67.7 (57.5–77.9)	NS
77.8 (70.5–85.1)	75.3 (66.2–84.4)	72.4 (65.6–79.2)	76.8 (66.6–87.1)	NS	76.1 (68.0–84.2)	78.1 (72.3–83.9)	72.0 (63.1–80.9)	NS
54.9 (46.1–63.8)	75.2 (66.4–83.9)	85.8 (80.7–90.8)	83.5 (74.2–92.7)	<0.001	69.5 (59.8–79.3)	73.1 (66.0–80.2)	63.9 (53.9–73.9)	NS
32.6 (24.3–40.9)	56.5 (45.8–67.3)	56.4 (48.4–64.4)	67.4 (55.2–79.6)	<0.001	46.3 (36.8–55.8)	50.0 (42.5–57.5)	40.6 (30.5–50.7)	NS
21.0 (14.1–27.8)	39.3 (27.8–50.8)	40.6 (32.7–48.6)	58.3 (45.6–71.0)	<0.001	36.3 (27.3–45.2)	38.6 (31.3–45.8)	20.4 (12.4–28.4)	<0.001
23.4 (16.4–30.4)	46.2 (35.1–57.3)	55.5 (47.4–63.5)	71.1 (59.8–82.4)	<0.001	35.6 (27.5–43.8)	51.0 (43.6–58.5)	29.3 (20.0–38.6)	<0.001
82.4 (74.9–89.8)	90.2 (81.7–98.7)	93.3 (87.9–98.7)	100 (NA)	<0.001	89.0 (80.8–97.1)	92.7 (88.2–97.2)	80.9 (71.6–90.3)	0.001
72.4 (64.1–80.6)	91.5 (86.0–97.0)	97.9 (96.0–99.8)	95.8 (91.0–100)	<0.001	89.5 (83.3–95.6)	86.5 (80.3–92.8)	77.4 (67.8–86.9)	0.005
71.3 (62.9–79.8)	91.6 (86.2–97.0)	95.9 (93.3–98.5)	96.5 (92.4–100)	<0.001	85.4 (77.1–93.8)	85.3 (79.4–91.2)	79.8 (70.4–89.2	NS
53.0 (44.1–61.9)	894 (83.2–95.6)	94.1 (90.8–97.4)	95.0 (90.0–100)	<0.001	79.9 (70.6–89.2)	78.2 (71.4–85.0)	62.7 (52.0–73.5)	<0.001
55.9 (47.1–64.7)	72.6 (63.4–81.8)	78.8 (71.8–85.8)	78.8 (68.7–88.8)	<0.001	65.9 (56.1–75.8)	69.7 (62.8–76.5)	64.4 (54.1–74.6)	NS
62.0 (53.3–70.7)	76.6 (67.9–85.4)	82.6 (75.7–89.4)	89.2 (81.9–96.6)	<0.001	72.1 (63.1–81.2)	76.7 (69.9–83.5)	66.7 (56.5–77.0)	NS
50.1 (41.3–58.9)	72.5 (63.4–81.7)	72.6 (64.6–80.7)	85.3 (76.9–93.7)	<0.001	58.6 (48.7–68.5)	71.1 (63.8–78.4)	56.2 (45.7–66.8)	0.003
53.3 (44.4–62.1)	69.4 (59.7–79.0)	70.9 (63.0–78.7)	72.6 (61.1–84.1)	<0.001	63.7 (54.1–73.4)	71.1 (64.6–77.5)	49.2 (38.8–59.7)	<0.001
63.5 (54.6–72.3)	90.0 (84.1–95.8)	87.4 (81.3–93.4)	97.1 (93.0–100)	<0.001	81.5 (73.0–90.0)	84.9 (78.9–90.8)	62.8 (52.1–73.5)	<0.001
31.2 (23.0–39.4)	35.4 (24.9–45.9)	52.3 (44.1–60.6)	58.6 (45.8–71.4)	<0.001	39.2 (29.9–48.6)	43.1 (35.8–50.4)	36.3 (26.2–46.4)	NS
54.3 (45.6–63.1)	44.9 (33.7–56.1)	54.6 (46.3–62.8)	75.3 (64.1–86.5)	NS	54.4 (44.6–64.1)	56.5 (49.1–63.8)	51.6 (41.2–62.0)	NS

health care facilities and to provide additional morgue space. Most had identified community-based alternate care sites; however, less than one half reported having formal written agreements with at least 1 site. Similarly, most reported community plans addressed mental health needs of victims and their families, emergency responders, and hospital staff, but few reported having formal written agreements with mental health providers.

Fewer than one half (46%) of hospitals reported that they had responded to a public health emergency or actual disaster since 2001; only 16% reported an emergency that substantially challenged the hospital's functional capacity. Twenty-seven percent reported that their community had prepared for a national security event.

Established Response Capability

Unweighted responses to items related to established response capability can be found in **Appendix Table 2** (available at www.annals.org). More than three quarters of hospitals had participated in community-wide emergency preparedness and response training since 2001, most often in a classroom setting. The median number of training topics per hospital was 3 (interquartile range, 2 to 4). More respondents (92.4%) reported that their hospitals had participated in community-wide drills or exercises than training; the median number of drills or exercises per hospital between 2001 and 2004 was 4 (interquartile range, 2 to 5). The median length of drills or exercises was 4 hours (interquartile range, 3 to 6 hours). Of the 1567 total reported

Table 4. **Associations between Weighted Basic Elements and Perceived Hazards and Experience Factors***

Basic Element	6 or More Perceived Hazards (95% CI), %		
	Yes	No	*P* Value
Collaborative planning process			
Collaborative threat and vulnerability analysis of community has been completed	84.0 (77.3–90.7)	81.2 (75.5–86.8)	NS
Existing health care coalition	74.5 (65.9–83.1)	65.7 (59.1–72.3)	0.031
Community has a crisis communication protocol	70.3 (61.8–78.9)	68.9 (62.7–75.1)	NS
Community emergency operations plan			
Community has a plan that addresses the hospital's need for additional supplies in the event of an emergency	56.3 (47.7–65.0)	57.8 (51.3–64.3)	NS
Community has a mechanism for credentialing staff during an emergency	67.9 (59.6–76.1)	60.3 (53.8–66.7)	NS
Community plan addresses the hospital's ability to expand capacity for decontamination	83.6 (77.5–89.7)	67.4 (60.8–73.9)	<0.001
Community plan addresses use of alternate sites of nonacute care	79.5 (73.5–85.4)	73.8 (68.1–79.4)	NS
Community plan addresses provisions for additional morgue space	78.9 (71.9–86.0)	64.3 (57.8–70.8)	<0.001
Community plan has a mechanism for tracking patient location	56.7 (48.2–65.2)	40.6 (34.3–46.9)	<0.001
Community has a plan to manage a large volume of calls regarding affected persons	40.9 (32.4–49.4)	28.2 (22.8–33.6)	0.002
Established response capability			
Hospital has participated in at least 3 community-wide trainings on emergency preparedness and response	51.4 (42.9–60.0)	34.2 (28.5–40.0)	<0.001
Hospital has participated in a community-wide emergency or disaster drill or exercise	92.3 (86.4–98.3)	86.0 (80.6–91.4)	0.025
Hospital shares information on the following areas			
Emergency department capacity	89.6 (83.4–95.8)	82.1 (76.5–87.7)	0.018
Inpatient bed capacity	88.0 (81.7–94.4)	81.4 (75.6–87.2)	0.041
Intensive care unit bed capacity	83.8 (76.5–91.1)	69.1 (62.5–75.7)	<0.001
Negative pressure room availability	78.1 (71.0–85.2)	61.2 (54.7–67.7)	<0.001
Decontamination capacity	82.6 (75.9–89.4)	67.1 (60.6–73.5)	<0.001
Ventilator availability	78.7 (71.2–86.3)	54.9 (48.3–61.5)	<0.001
Hospital IMS was developed with the community emergency management agency	68.3 (60.0–76.6)	59.5 (53.1–66.0)	0.038
Community IMS has an emergency operations center that has been tested through drills	79.6 (72.1–87.1)	76.4 (70.2–82.7)	NS
Ongoing surveillance, reporting, and laboratory identification			
Hospital has access to live answers from public health personnel around the clock	46.6 (38.0–55.2)	36.5 (30.3–42.6)	0.02
Hospital has a direct electronic link to the state Health Alert Network	53.2 (44.7–61.7)	55.1 (48.6–61.5)	NS

* Estimates displayed are based on a weighted analysis that was conducted to approximate a nationally representative sample. IMS = incident management system; NS = not significant.

drills or exercises for which complete time and date information was specified, 78% occurred entirely within a single day shift and only 9% lasted longer than 24 hours. Few of these exercises (36.6%) were unannounced.

Most respondents reported that their community emergency operations plan used a formal incident management system and designated where incident management would occur if there was no emergency scene. Regarding communication, fewer than half of the hospitals had around-the-clock access to a live voice from a public health department (43%) or volunteer organization (41%) representative.

Surveillance, Reporting, and Laboratory Identification

Fewer than one half of responding hospitals reported that their community plan addressed laboratory testing for individual category A agents in the unweighted analysis (**Appendix Table 3**, available at www.annals.org). Approximately 52% reported that they could request laboratory testing and receive results around the clock. Of all respondents, 55.6% had a direct electronic link to their state's Health Alert Network and 54.5% reported that their communities had developed standardized epidemiologic forms for case identification.

Overall Perception of Practice

After completing the questionnaire, hospital representatives were asked a single global question in an effort to identify best practices related to linkages: "Do you believe your hospital and community are potential examples of exemplary practice?" Forty-five percent of hospitals responded positively to this question.

Basic Elements of Linkages and Their Association with Hospital Characteristics, Hazards, and Experience Factors

Table 3 presents the weighted associations between the 17 basic elements of linkages and demographic characteristics. In general, the analysis showed that positive responses on many linkage items were significantly higher among hospitals that were located in urban areas, those with a higher average daily census, and those that became involved in community planning before 2001. However, a higher proportion of rural hospitals reported that their community plan addressed alternate sites of care. There were no significant associations between demographic factors and 3 elements: hospital linkage to the state Health Alert Network, a community plan that addressed creden-

Table 4—Continued

Previous Experience Preparing for a National Security Event (95% CI), %			Responded to a Public Health Emergency or Actual Disaster in the Community (95% CI), %		
Yes	No	*P* Value	Yes	No	*P* Value
87.7 (81.9–93.4)	80.5 (75.1–85.8)	NS	83.4 (77.4–89.5)	81.3 (75.2–87.4)	NS
85.6 (77.8–93.4)	63.8 (57.5–70.0)	<0.001	79.7 (73.9–85.6)	61.4 (53.9–68.9)	<0.001
84.6 (78.4–90.8)	65.0 (58.9–71.1)	<0.001	74.8 (68.3–81.3)	65.8 (58.7–72.9)	0.022
74.2 (66.8–81.5)	52.3 (46.2–58.5)	<0.001	61.9 (54.8–69.1)	54.1 (46.9–61.4)	NS
72.4 (64.1–80.7)	60.2 (54.0–66.3)	0.011	69.3 (62.5–76.1)	58.6 (51.4–65.9)	0.010
88.3 (81.3–95.2)	68.6 (62.7–74.5)	<0.001	80.9 (75.3–86.5)	67.7 (60.6–74.8)	<0.001
71.6 (63.1–80.0)	77.0 (72.1–81.9)	NS	75.1 (69.0–81.2)	76.2 (70.4–82.0)	NS
83.4 (75.9–90.9)	65.3 (59.3–71.3)	<0.001	79.3 (73.1–85.6)	62.7 (55.6–69.9)	<0.001
67.2 (59.1–75.3)	40.0 (34.0–46.0)	<0.001	54.4 (47.5–61.2)	40.7 (33.6–47.8)	0.001
50.9 (41.9–60.0)	27.2 (21.9–32.5)	<0.001	39.7 (33.0–46.5)	27.8 (21.6–34.1)	0.003
58.3 (49.3–67.3)	34.9 (29.3–40.5)	<0.001	48.4 (41.5–55.3)	34.7 (28.1–41.4)	0.001
97.7 (95.5–100)	85.5 (80.3–90.7)	<0.001	91.1 (85.7–96.5)	86.2 (80.4–92.0)	NS
94.2 (87.9–100)	81.9 (76.8–87.1)	<0.001	92.6 (89.0–95.5)	79.5 (72.9–86.0)	<0.001
93.6 (89.6–97.6)	80.8 (75.3–86.3)	<0.001	91.8 (88.0–95.5)	78.4 (71.7–85.1)	<0.001
89.3 (82.2–96.3)	69.7 (63.6–75.9)	<0.001	85.2 (79.7–90.7)	66.8 (59.5–74.2)	<0.001
82.2 (75.6–88.8)	62.6 (56.5–68.6)	<0.001	76.0 (70.0–82.0)	61.1 (53.9–68.3)	<0.001
82.7 (74.8–90.6)	69.4 (63.6–75.3)	0.003	81.0 (75.3–86.6)	66.8 (59.7–73.9)	<0.001
76.9 (68.6–85.3)	59.2 (53.0–65.4)	<0.001	76.3 (70.4–82.3)	54.3 (47.0–61.7)	<0.001
75.6 (68.4–82.8)	58.8 (52.6–64.9)	<0.001	66.6 (59.9–73.3)	59.9 (52.6–67.1)	NS
90.4 (85.5–95.4)	73.7 (67.7–79.7)	<0.001	84.5 (78.5–90.4)	72.8 (65.9–79.8)	0.001
57.1 (48.1–66.0)	35.1 (29.4–40.8)	<0.001	46.0 (39.1–52.9)	35.9 (28.9–42.9)	0.016
57.1 (48.0–66.3)	53.6 (47.5–59.7)	NS	56.1 (49.2–63.0)	53.3 (46.1–60.5)	NS

tialing, and completion of a threat and vulnerability analysis in collaboration with the community.

There were many significant associations in the weighted analyses between the 17 basic elements (23 items total) and perceived hazards and experience factors (**Table 4**). A perceived high number of hazards was associated with 8 items at a *P* value less than 0.001 and with 7 items at a *P* value less than 0.05. Previous preparation for a national security event was associated with 17 items at a *P* value less than 0.001 and with 2 items at a *P* value less than 0.05. Experience responding to an actual event was associated with 9 items at a *P* value less than 0.001 and with 7 items at a *P* value less than 0.05. The high number of significant associations in the bivariate analyses may be related to correlations among the factors.

Discussion

The study accomplished a cross-sectional baseline assessment of community emergency preparedness linkages among hospitals, public health agencies, and traditional first responders in a national sample of hospitals. Our study focused on hospital integration related to 4 domains: the community emergency preparedness and response planning process; the community emergency operations plan; established response capability; and ongoing surveillance, reporting, and laboratory identification.

The range of departments in which hospital contact persons were employed suggests that primary responsibility for hospital emergency preparedness varies widely. Consequently, no single discipline or professional group can be identified as consistently responsible for hospital preparedness, making it difficult for community groups to determine the appropriate hospital liaison. The relatively low percentage of senior leaders completing the questionnaire may indicate insufficient resources or executive attention devoted to emergency preparedness planning.

Having representation from each of the key stakeholders in the community planning process is essential to establishing good linkages. Many communities lacked involvement by media outlets and volunteer organizations, both of which are integral to an effective response (10, 11). Some hospitals reported that their communities did not have a crisis communication protocol, an important strategy to provide consistent messages, reduce anxiety levels, and deter concerned persons from seeking care unnecessar-

ily (12). Many hospitals also reported no community plans to augment hospital-based surge capacity in the area of pharmaceuticals, supplies, equipment, and isolation. Lack of sufficient plans in these areas could have severe consequences if a serious incident occurs (such as an outbreak of severe acute respiratory syndrome).

The Joint Commission accreditation requirements (13) may partially explain why almost all hospitals were engaged in community-wide drills or exercises. Unfortunately, most drills and exercises were short and included only staff on day shifts, which is clearly inadequate for actual emergencies that can occur at any time. The small proportion of respondents involved in community-wide exercising of the SNS is similar to recent reports in which fewer than one half of respondents from state and local public health departments reported that they had exercised their SNS plans (14); only 6 states had adequate capacity to deliver and administer vaccines and antidotes from the stockpile (15). The Centers for Disease Control and Prevention's proposed budget for fiscal year 2006 incorporates an increase of more than 50% for the SNS program (16); however, funding for exercising the SNS was not included (17).

Early detection, identification, and intervention at the local level (6, 18), together with ongoing surveillance and reporting, are essential for managing bioterrorist events or infectious disease outbreaks. We have identified opportunities for improving coordination among hospitals, public health departments, and laboratories, including the need for more direct links to the state Health Alert Network, more standardized epidemiologic forms, and around-the-clock ability to request tests and receive laboratory results. These findings are consistent with a recent report that two thirds of the states do not use the Internet to collect disease outbreak information, which would cause serious delays in reporting and could potentially impede early warning of disease threats (15).

In general, urban and large hospitals demonstrated similar performance on the basic elements of community preparedness linkages that we identified in this study, but small and rural hospitals varied. This finding is consistent with patterns of preparedness funding in which larger hospitals in urban areas received greater assistance (19). The association between several basic elements and previous experience with coordinating national security events could suggest that such experience is actually a proxy for the overall quality of community preparedness. This might lead one to conclude that the federal coordination involved in preparing for major events is an effective stimulus for promoting linkages and actual preparedness. On the other hand, the association could be indirect; for example, the communities received increased funding that could have caused the improved preparedness. Of interest, other studies also found greater public health preparedness after involvement in a national security event (20, 21).

The research team did not expect that nearly half of all respondents would consider their hospital and community to be potential examples of exemplary practice. The high estimation of exemplary practice by respondents might be explained by 1 or more of the following factors: a sincere belief based on evidence or experience that they are well linked, a tendency to overestimate personal capability (22, 23), naive beliefs regarding the level of preparedness necessary for an effective response, and the possibility of response bias.

A few previous studies have investigated specific aspects of hospital and community emergency preparedness linkages. Before fall 2001, several studies reported low levels of preparedness linkages between hospitals and communities but substantial improvements thereafter (24–28). In one study, local and state health officials declared that the most important preparedness enhancements have involved developing strong relationships and connectivity with hospitals and other entities (29).

This study has 4 main limitations. First, the responses reflect only the hospitals' perception of their community linkages. It is unclear whether community stakeholders share these perceptions, and no objective source documents were available for verification. As with all survey research, the results are limited by respondents' knowledge about specific topic areas.

Second, the overall response rate was low, and small and rural hospitals were underrepresented. The weighted analysis was designed to address this issue. It is possible that hospitals that did not respond to the invitation were substantially less integrated into community planning than those who participated. Another potential bias is that respondents may have tended to report better linkages because the questionnaire came from the Joint Commission.

Third, the questionnaire addressed a broad range of topics but did not assess the quality or actual effectiveness of hospital and community linkages in each area. For example, most hospitals reported completing a threat and vulnerability analysis in conjunction with the community, but we do not know if these were comprehensive evaluations that included hazard identification, vulnerability assessment, and risk analysis (30). The selection of the basic elements of community emergency preparedness linkages was an initial attempt to prioritize linkage issues; however, the study team cautions that additional consideration by local and national experts is needed before further use.

Fourth, many specific items in community plans were assessed, but experience has demonstrated that implementation often fails to proceed according to plan. Future studies should use a standardized approach to evaluate drills or event responses so that assessments can be compared with preevent information about linkages and the planning process. Additional research, preferably by a team of multidisciplinary experts, is needed to evaluate the quality of linkage relationships and planning activities and to define a threshold of adequate integration in critical hospital–community interfaces. Periodic reevaluation of linkages would allow policymakers to assess progress over time.

To our knowledge, this study is the first large-scale, national assessment of hospital integration into community emergency preparedness. Overall, responding hospitals reported a substantial degree of integration into community preparedness planning and familiarity with local emergency response plans. At the same time, results related to communication and planning with local public health departments suggest that relationships between hospitals, public health agencies, and other critical community response resources are not adequately robust. The results also suggest a need for greater attention to basic linkage elements among rural hospitals. Rural hospitals have a unique need for collaborative planning regarding surge capacity given severe constraints in equipment and supplies, limited access to medical specialists and additional staff, and an environment that often includes physical proximity to hazardous materials and the threat of agroterrorism (4).

Specific recommendations for enhancing linkages relate to exercises and coordination. Plans are most effective when rigorously exercised. Drills and exercises should be designed to stress the community system-level response over time, and they should address event notification, communication, resource allocation, and patient management. Financial support and other incentives are needed to increase the rigor and scope of community-wide exercises to ensure that response capacity and capability meet the expectations of the U.S. public.

Coordination among health care organizations and between health care and community planning groups should be enhanced. Health care organizations can form coalitions to facilitate a community-wide inventory of medical assets and ensure that they are not each relying on the same constrained community resources. Health care coalitions can also establish a uniform interface with the jurisdiction's incident management system (31). Community planning groups, which are generally better integrated with public health personnel, should reach out to health care providers so that public health departments and providers effectively complement their respective response capabilities. Similarly, health care organizations should clearly understand their role in the community incident command system to ensure compatibility across incident command structures.

Furthermore, the accuracy of both the hospital's perception of its linkages and that of emergency preparedness experts would be greatly enhanced if there were a benchmark for measuring the effectiveness of linkages. For many years, hospitals have desired clearer guidance on expectations for preparedness, such as achievable, objective national standards. The call for national standards is coming from other stakeholders as well, particularly those charged with evaluating the capacity of the public health and safety systems to respond to terrorist events and those responsible for evaluating the impact of substantial funding increases since 2002 (3, 15, 16, 32–37). A nationally accepted model is useful for several purposes: establishing accepted expectations for preparedness, tracking and accounting for federal preparedness funds, and determining which programs or areas need improvement.

With or without national standards for linkages, policymakers should consider offering incentives to drive improvements and help counter the current hospital financial environment. Hospitals are continually asked to do more with less (38), and they face the likelihood of additional cuts to reimbursement (39). Although post-2001 funding for hospital preparedness has improved the national state of preparedness, future funding for hospital, state, and local public health preparedness is likely to decrease (17). Unlike public sector organizations, local governmental authorities lack direct control over private health care assets and therefore have less leverage to promote participation (2). There is a natural tendency to shift attention away from preparedness toward more immediate issues as the memory of major events recedes. One must remember that the quality of community linkages is just 1 aspect of preparedness that will influence hospital ability to respond to an event. Other major issues to consider include limited bed capacity when hospitals are full, seriously overcrowded emergency departments, and potential failures related to the civil infrastructure (for example, electricity, water, and fuel).

In conclusion, future events and disasters will require local leadership, emergency responders, hospital staff, and other health care providers to manage a coordinated response. Preestablishing strong linkages for preparedness and response among community stakeholders should be useful for pandemic influenza, earthquakes, and train derailments, as well as terrorist events. Growing evidence suggests that hospital and community linkages have substantially improved in recent years, but more improvement is needed. The process of building and maintaining linkages through collaborative planning must be dynamic. Plans should evolve as people, threats, systems for detection and response, and funding priorities change (40). Complacency must not compromise our national progress toward achieving strong linkages among the entities that are critical to limiting the human impact of future disasters.

From Joint Commission on Accreditation of Healthcare Organizations, Oakbrook, Illinois, and George Washington University Institute for Crisis, Disaster and Risk Management, Washington, DC.

Acknowledgments: The authors thank the hospital staff who participated in the project and committed substantial time and effort to complete the questionnaire. The authors also thank the members of the technical expert panel for their assistance: Mark Ackermann, St. Vincent's Catholic Medical Center of New York; Christine Bradshaw, DO, MPH, Centers for Disease Control and Prevention, Public Health Practice Program Office; Ed Gabriel, EMT-P, New York City Office of Emergency Management; Darlene Isbell-Gidley, RN, MPH, Orange County California Health Care Agency; Jane Maffie-Lee, MSN, RN-CS, Manet Community Health Center, Quincy, Massachusetts; Ralph Morris, MD, MPH, Public Health Preparedness, Minnesota Department of Health, Bemidji, Minnesota; Sally Phillips, RN, PhD, Agency for Healthcare Research and Quality; Barbara Russell, RN, MPH, ACRN, CIC, Infection Control Services, Baptist Hospital of Miami, Miami,

Florida; Tim Sashko, Fire Chief, Fire Department, Buffalo Grove, Illinois; and Steve Smith, MPH, USPHS, Bureau of Primary Health Care, Division of Clinical Quality, Health Resources and Services Administration, Rockville, Maryland. The authors also thank Dennis O'Leary, MD; Chandrika Divi, MPH; Scott Williams, PsyD; Mark Beezhold; Brette Tschurtz; and Tasha Mearday for their contributions.

Grant Support: In part by a grant from the Agency for Healthcare Research and Quality as part of its Partnerships for Quality Initiative (Cooperative Agreement Number 1U 18HS13728-01).

Potential Financial Conflicts of Interest: *Consultancies:* J.A. Barbera (Joint Commission on Accreditation of Healthcare Organizations); *Grants received:* B.I. Braun (Agency for Healthcare Research and Quality), N.V. Wineman (Agency for Healthcare Research and Quality), N.L. Finn (Agency for Healthcare Research and Quality), J.M. Loeb (Agency for Healthcare Research and Quality).

Requests for Single Reprints: Nicole V. Wineman, MA, MPH, MBA, Joint Commission on Accreditation of Healthcare Organizations, Division of Research, 1 Renaissance Boulevard, Oakbrook Terrace, IL 60181; e-mail, nwineman@jcaho.org.

Current author addresses and author contributions are available at www.annals.org.

References

1. **Hick JL, Hanfling D, Burstein JL, DeAtley C, Barbisch D, Bogdan GM, et al.** Health care facility and community strategies for patient care surge capacity. Ann Emerg Med. 2004;44:253-61. [PMID: 15332068]
2. **Rubin JN.** Recurring pitfalls in hospital preparedness and response. January 2004. Accessed at www.homelandsecurity.org/journal/Articles/displayarticle.asp?article=101 on 4 March 2005.
3. **Turnock B.** Public Health Preparedness at a Price: Illinois. A Century Foundation Report. 29 January 2004. Accessed at www.tcf.org/Publications/HomelandSecurity/Turnock.pdf on 11 March 2005.
4. **Gursky EA.** Hometown hospitals: the weakest link? Bioterrorism readiness in America's rural hospitals. June 2004. Accessed at www.ndu.edu/ctnsp/Def_Tech/Hometown_Hospitals.pdf on 14 March 2005.
5. **Schultz CH, Mothershead JL, Field M.** Bioterrorism preparedness. I: The emergency department and hospital. Emerg Med Clin North Am. 2002;20:437-55. [PMID: 12120486]
6. **O'Leary M.** The First 72 Hours: A Community Approach to Disaster Preparedness. New York: iUniverse; 2004.
7. **Flowers LK, Mothershead JL, Blackwell TH.** Bioterrorism preparedness. II: The community and emergency medical services systems. Emerg Med Clin North Am. 2002;20:457-76. [PMID: 12120487]
8. **American Hospital Association.** Annual Survey Database for Fiscal Year 2003 Data. Chicago: Health Forum; 2004.
9. **Woodruff RS.** A simple method for approximating the variance of a complicated estimate. Journal of the American Statistical Association. 1971;66:411-4.
10. **Joint Commission on Accreditation of Healthcare Organizations.** Health Care at the Crossroads: Strategies for Creating and Sustaining Community-wide Emergency Preparedness Systems. 2003. Accessed at www.jointcommission.org/PublicPolicy/Emergency_Preparedness.htm on 30 March 2006.
11. **Clizbe JA.** Challenges in managing volunteers during bioterrorism response. Biosecur Bioterror. 2004;2:294-300. [PMID: 15650439]
12. **Wray RJ, Kreuter MW, Jacobsen H, Clements B, Evans RG.** Theoretical perspectives on public communication preparedness for terrorist attacks. Fam Community Health. 2004;27:232-41. [PMID: 15596970]
13. **Joint Commission Resources on Accreditation of Healthcare Organizations.** Comprehensive Accreditation Manual for Hospitals: Management of the Environment of Care Standard EC. 1.4. Oakbrook Terrace, IL: Joint Commission Resources; 2001.
14. **House Select Committee on Homeland Security.** Bioterrorism: America still unprepared. October 2004. Accessed at www.house.gov/hsc/democrats/pdf/hsc_docs/finalreportwithcover.pdf on 11 March 2005.
15. Trust for America's Health. Ready or not? Protecting the public's health in the age of bioterrorism. December 2004. Accessed at http://healthyamericans.org/reports/bioterror04/ on 11 March 2005.
16. **U.S. Department of Health and Human Services.** Fiscal year 2006 budget in brief. Accessed at www.hhs.gov/budget/06budget/FY2006BudgetinBrief.pdf on 24 March 2005.
17. **The Association of State and Territorial Health Officials.** Public health preparedness. February 2005. Accessed at www.astho.org/newsletter/newsletters/9/index.html on 24 March 2005.
18. **Mothershead JL, Tonat K, Koenig KL.** Bioterrorism preparedness. III: State and federal programs and response. Emerg Med Clin North Am. 2002;20:477-500. [PMID: 12120488]
19. **Health Resources and Services Administration.** National Bioterrorism Hospital Preparedness Program fiscal year 2005 continuation guidance. HRSA Announcement No. 5-U3R-05-001. Accessed at www.hrsa.gov/grants/preview/guidancespecial/hrsa05001.htm on 9 June 2005.
20. **U.S. General Accounting Office.** SARS Outbreak: Improvements to Public Health Capacity Are Needed for Responding to Bioterrorism and Emerging Infectious Diseases. Washington, DC: U.S. General Accounting Office; 2003.
21. **Fricker RD, Jacobson JO, Davis LM.** Measuring and evaluating local preparedness for a chemical or biological terrorist attack. Accessed at www.rand.org/publications/IP/IP217/ on 11 March 2005.
22. **Gordon MJ.** A review of the validity and accuracy of self-assessments in health professions training. Acad Med. 1991;66:762-9. [PMID: 1750956]
23. **Kruger J, Dunning D.** Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments. J Pers Soc Psychol. 1999;77:1121-34. [PMID: 10626367]
24. **Hoard ML, Williams JM, Helmkamp JC, Furbee PM, Manley WG, Russell FK.** Preparing at the local level for events involving weapons of mass destruction. September 2002. Accessed at www.cdc.gov/ncidod/EID/vol8no9/01-0520.htm on 14 March 2005.
25. **Braun BI, Darcy L, Divi C, Robertson J, Fishbeck J.** Hospital bioterrorism preparedness linkages with the community: improvements over time. Am J Infect Control. 2004;32:317-26. [PMID: 15454887]
26. **Davis LM, Blanchard JC.** Are Local Health Responders Ready for Biological and Chemical Terrorism? Santa Monica, CA: RAND; 2002.
27. **U.S. General Accounting Office.** Hospital Preparedness: Most Urban Hospitals Have Emergency Plans but Lack Certain Capacities for Bioterrorism Response. Washington, DC: U.S. General Accounting Office; 2003.
28. **McHugh M, Staiti AB, Felland LE.** How prepared are Americans for public health emergencies? Twelve communities weigh in. Health Aff (Millwood). 2004;23:201-9. [PMID: 15160818]
29. **Gursky E.** Progress and peril: bioterrorism preparedness dollars and public health. 19 January 2004. Accessed at www.tcf.org/Publications/HomelandSecurity/Gursky_Progress_Peril.pdf on 11 March 2005.
30. **O'Leary M.** Measuring Disaster Preparedness: A Practical Guide to Indicator Development and Application. New York: iUniverse; 2004.
31. **Barbera J, Macintyre A.** Medical Surge Capacity and Capability: A Management System for Integrating Medical and Health Resources during Large-Scale Emergencies. Washington, DC: U.S. Department of Health and Human Services; 2004.
32. **The Century Foundation.** Breathing easier? Report of The Century Foundation working group on bioterrorism preparedness. 13 January 2005. Accessed at www.tcf.org/Publications/HomelandSecurity/breathingeasier.pdf on 11 March 2005.
33. **Lurie N.** Public health preparedness in California: lessons from seven jurisdictions. Testimony presented to the California Senate Committee on Health and Human Services. 2 June 2004. Accessed at www.rand.org/publications/CT/CT227/CT227.pdf on 14 March 2005.
34. **Lurie N, Wasserman J, Stoto M, Myers S, Namkung P, Fielding J, et al.** Local variation in public health preparedness: lessons from California. Accessed at http://content.healthaffairs.org/cgi/reprint/hlthaff.w4.341v1.pdf on 14 March 2005.
35. **U.S. General Accounting Office.** Homeland security: coordinated planning and standards needed to better manage first responder grants in the national capital region. Accessed at www.gao.gov/new.items/d04904t.pdf on 15 March 2005.

36. **Gilmore Commission.** Fourth annual report to the President and the Congress of the advisory panel to assess domestic response capabilities for terrorism involving weapons of mass destruction IV: implementing the national strategy. 15 December 2002. Accessed at www.rand.org/nsrd/terrpanel/terror4.pdf on 21 March 2004.
37. **Falkenrath RA.** Problems of preparedness: challenges facing the U.S. domestic preparedness program. John F. Kennedy School of Government Discussion Paper 2000-28. Accessed at http://bcsia.ksg.harvard.edu/BCSIA_content/documents/The_Problems_of_Preparedness.pdf on 31 March 2006.
38. **Barbera JA, Macintyre AG, DeAtely CA.** Ambulances to nowhere: America's critical shortfall in medical preparedness for catastrophic terrorism. John F. Kennedy School of Government Discussion Paper ESDP-2001-07. Accessed at http://bcsia.ksg.harvard.edu/BCSIA_content/documents/Ambulances_to_Nowhere.pdf on 31 March 2006.
39. **Pear R.** Cut in hospitals' Medicare payments urged. The New York Times. 18 January 2005:A17.
40. **Perry RW, Lindell MK.** Preparedness for emergency response: guidelines for the emergency planning process. Disasters. 2003;27:336-50. [PMID: 14725091]

Current Author Addresses: Dr. Braun, Ms. Wineman, Ms. Finn, and Drs. Schmaltz and Loeb: Joint Commission on Accreditation of Healthcare Organizations, Division of Research, 1 Renaissance Boulevard, Oakbrook Terrace, IL 60181.

Dr. Barbera: Institute for Crisis, Disaster and Risk Management, The George Washington University, 1776 G Street NW, Suite 110, Washington, DC 20052.

Author Contributions: Conception and design: B.I. Braun, J.A. Barbera, J.M. Loeb.

Analysis and interpretation of the data: B.I. Braun, N.V. Wineman, N.L. Finn, S.P. Schmaltz.

Drafting of the article: B.I. Braun, N.V. Wineman.

Critical revision of the article for important intellectual content: N.L. Finn, J.A. Barbera, J.M. Loeb.

Final approval of the article: J.M. Loeb.

Statistical expertise: S.P. Schmaltz.

Obtaining of funding: B.I. Braun, J.M. Loeb.

Administrative, technical, or logistic support: N.V. Wineman, N.L. Finn, J.M. Loeb.

Collection and assembly of data: B.I. Braun, N.V. Wineman, N.L. Finn.

Appendix

Terminology

An *event requiring national security oversight,* as defined in the National Response Plan (41), is one that, by virtue of its political, economic, social, or religious significance, may be the target of terrorism or other criminal activity. Examples of national special security events include presidential inaugurations, the Olympics, national political conventions, the Super Bowl, and the United Nations General Assembly (42).

The *National Incident Management System* (43) delineates a standard method for managing any large-scale incident in the United States. All organizations seeking to maintain eligibility for federal preparedness funding will be required to incorporate this method into their preparedness plans. The system's incident command protocol provides terminology and concepts for interface between different organizations during incident response. These concepts should be considered in developing any final model for hospital linkages and should be used when designing future research questionnaires in this area.

The Centers for Disease Control and Prevention's *Strategic National Stockpile* (SNS) has large quantities of medicine and medical supplies to protect the U.S. public if there is a public health emergency (for example, a terrorist attack, influenza outbreak, or earthquake) severe enough to exhaust local supplies. After federal and local authorities agree that the SNS is needed, medicines will be delivered to any state in the country within 12 hours. Each state has plans to receive and distribute SNS medicine and medical supplies to local communities as quickly as possible (44).

A *Metropolitan Statistical Area* is a county or group of contiguous counties that contains at least 1 city with a population of 50 000 people or more or a U.S. Census Bureau–defined urbanized area of at least 50 000 people with a metropolitan population of at least 100 000 people. In addition to the county containing the main city or urbanized area, a Metropolitan Statistical Area may contain other counties that are metropolitan in character and are economically and socially integrated with the central counties. In New England, cities and towns (rather than counties) are used to define Metropolitan Statistical Areas (45).

Additional Tools and Related Initiatives

Strategies to achieve compliance with national preparedness standards, if they were to be developed, have been described by the Congressional Research Service, and some have already been implemented (46). In addition, recent national initiatives are likely to facilitate improvements in linkages. These include the National Response Plan (41) and the Homeland Security Presidential Directive 8 (47), which calls for the development of a national preparedness goal and a national preparedness assessment and reporting system. Both the Health Services and Resources Administration and the Centers for Disease Control and Prevention have been working toward establishing goals and indicators for hospital and public health preparedness, respectively (19, 48). The Office of the Assistant Secretary for Public Health Emergency Preparedness has issued cross-cutting critical benchmarks that apply both to hospitals funded by the Health Services and Resources Administration and to public health agencies supported by the Centers for Disease Control and Prevention. The Agency for Healthcare Research and Quality has produced several helpful documents and tools related to emergency preparedness planning and response, such as guides for dispensing mass quantities of prophylactic medications to communities, evaluating drills, and developing emergency contact centers (49–51).

References

41. **U.S. Department of Homeland Security.** National response plan. December 2004. Accessed at www.dhs.gov/interweb/assetlibrary/NRP_FullText.pdf on 14 March 2005.

42. **U.S. Department of Homeland Security.** National special security events fact sheet. Accessed at www.dhs.gov/dhspublic/display?content=1065 on 22 November 2005.

43. **U.S. Department of Homeland Security.** National Incident Management System. Washington, DC: U.S. Department of Homeland Security; 2004.

44. **Centers for Disease Control and Prevention.** Strategic national stockpile. 14 April 2005. Accessed at www.bt.cdc.gov/stockpile/ on 7 November 2005.

45. **Centers for Disease Control and Prevention.** National Center for Health Statistics: definitions. Accessed at www.cdc.gov/nchs/datawh/nchsdefs/placeofres.htm#msa on 7 November 2005.

46. **Canada B.** Homeland security: standards for state and local preparedness. Congressional Research Service Report for Congress. 30 September 2003. Accessed at http://fpc.state.gov/documents/organization/13386.pdf on 10 April 2006.

47. **U.S. Department of Homeland Security.** Homeland Security Presidential Directive (HSPD-8): National Preparedness. Washington, DC: The White House; 2003.

48. **Centers for Disease Control and Prevention.** Continuation guidance for cooperative agreement on public health preparedness and response for bioterrorism: budget year five. Program announcement 99051. 14 June 2004. Accessed at www.bt.cdc.gov/planning/continuationguidance/pdf/guidance_intro.pdf on 11 March 2005.

49. **Hupert N, Cuomo J, Callahan MA, Mushlin AI, Morse SS.** Community-Based Mass Prophylaxis: A Planning Guide for Public Health Preparedness. AHRQ Publication No. 04-0044. Rockville, MD: Agency for Healthcare Research and Quality; 2004.

50. **Cosgrove SE, Jenckes MW, Kohri K, Hsu EB, Green G, Feuerstein CJ, et al.** Evaluation of Hospital Disaster Drills: A Module Based Approach. AHRQ Publication No. 04-0032. Rockville, MD: Agency for Healthcare Research and Quality; 2004.

51. **Bogdan GM, Scherger DL, Brady S, Keller D, Seroka AM, Wruk KM, et al.** Health Emergency Assistance Line and Triage Hub (HEALTH) Model. AHRQ Publication No. 05-0040. Rockville, MD: Agency for Healthcare Research and Quality; 2004.

Appendix Table 1. Community Planning Process and Linkage-Related Topics Addressed in Community Emergency Operations Plan*

Variable	Respondents, *n* (%)†
Community planning process	
Year in which hospital initially became involved in community planning	
1950–1989	147 (26.7)
1990–2000	254 (46.1)
2001–2004	150 (27.2)
Community has an EOP	516 (89.9)
EOP specifically addresses health and medical response	507 (88.2)
Entities with representatives in the community planning group‡	
Emergency management	531 (92.4)
Law enforcement	529 (92.0)
Health care	529 (92.0)
Emergency medical services	528 (92.0)
Fire services	525 (91.3)
Public health	490 (85.2)
Hazardous material management	436 (76.0)
Public safety communications	417 (73.0)
Public works	363 (63.1)
Volunteer organizations	360 (63.0)
Governmental/administrative	336 (58.4)
Medical examiner/coroner	224 (39.0)
Industry/manufacturing	219 (38.0)
Local media	186 (32.4)
Professional groups	145 (25.2)
Academic groups	128 (22.3)
Forensic experts	76 (13.2)
Other	132 (23.0)
Not applicable	10 (1.7)
No response	3 (0.5)
Linkage-related topics	
Procurement of additional supplies, equipment, and pharmaceuticals	
Hospital's need for additional supplies and equipment	353 (61.4)
Sources for pharmaceuticals‡	
Local pharmaceutical stockpile	260 (45.2)
Regional pharmaceutical stockpile	303 (52.7)
State pharmaceutical stockpile	255 (44.4)
SNS	60 (10.4)
No community plan addressing the issue	59 (10.3)
Don't know	50 (8.7)
Other	56 (9.7)
Receiving, storing, and distributing the SNS	
Yes	423 (73.6)
No	84 (14.6)
Don't know	68 (11.8)
Community plan regarding SNS has been shared with the hospital	328 (57.0)
Local agency responsible for managing the distribution of the SNS	
Fire services	16 (2.8)
Emergency medical services	35 (6.1)
Law enforcement	18 (3.1)
Local public health department	375 (65.2)
Don't know	72 (12.5)
Not applicable	12 (2.1)
Other	127 (22.1)

Continued

Appendix Table 1—Continued

Variable	Respondents, *n* (%)†
Surge capacity	
Expansion of hospital capacity	
Decontamination	
Yes	443 (77.0)
No	100 (17.4)
Don't know	32 (5.6)
Support ventilator-dependent patients	
Yes	268 (46.6)
No	231 (40.2)
Don't know	76 (13.2)
Isolation	
Yes	322 (56.0)
No	199 (34.6)
Don't know	54 (9.4)
Alternate sites of nonacute care identified	
Yes	424 (74.3)
No	88 (15.4)
Don't know	59 (10.3)
Formal written agreement with at least 1 site	253 (44.0)
Provisions for additional morgue space	
Yes	419 (73.0)
No	88 (15.3)
Don't know	66 (11.5)
Not applicable	1 (0.2)
Alternate morgue sites identified‡	
Using another health care facility's morgue space	91 (15.8)
Refrigerated trucks	329 (57.2)
Ice rinks	43 (7.5)
Other	112 (19.5)
No	88 (15.3)
Don't know	66 (11.9)
Immunization and prophylaxis	
Hospital participates in immunization and prophylaxis	
Yes	278 (48.5)
No	248 (43.3)
Don't know	47 (8.2)
Group-specific needs	
First responders	
Yes	444 (77.2)
No	56 (9.7)
Don't know	73 (12.7)
Not applicable	2 (0.3)
Hospital personnel	
Yes	451 (78.4)
No	72 (12.5)
Don't know	49 (8.5)
Not applicable	3 (0.5)
General population	
Yes	395 (68.8)
No	69 (12.0)
Don't know	107 (18.6)
Not applicable	3 (0.5)
Mass casualty management	
Mechanism for tracking patient location through the health care system	
Yes	274 (47.9)
No	138 (24.1)
Don't know	160 (28.0)
Large volume of calls	
Yes	204 (35.7)
No	123 (21.5)
Don't know	245 (42.8)

Continued

Appendix Table 1—Continued

Variable	Respondents, *n (%)*†
Nontraditional modes of transportation for moving patients to health care facilities‡	
Taxi	75 (13.0)
Helicopter	277 (48.2)
Private ambulance	115 (20.0)
Bus	416 (72.4)
Other	15 (2.6)
Don't know	102 (17.7)
Mental health needs	
Victims	
Yes	377 (66.3)
No	73 (12.8)
Don't know	119 (20.9)
Formal written agreement	182 (32.0)
Family of victims	
Yes	371 (65.2)
No	74 (13.0)
Don't know	124 (21.8)
Formal written agreement	167 (29.4)
Hospital staff	
Yes	380 (66.9)
No	88 (15.5)
Don't know	100 (17.6)
Formal written agreement	197 (34.7)
"Worried well"	
Yes	317 (55.8)
No	107 (18.8)
Don't know	144 (25.4)
Formal written agreement	144 (25.4)
Emergency responders	
Yes	381 (67.4)
No	74 (13.1)
Don't know	110 (19.5)
Formal written agreement	192 (34.0)

* Unweighted estimates based on responding hospitals. EOP = emergency operations plan; SNS = Strategic National Stockpile.
† Because of rounding, percentages do not total 100.
‡ Questionnaire allowed respondents to check all options that applied; percentages do not total 100.

Appendix Table 2. Linkage Items Related to Characteristics of Established Response Capability*

Variable	Respondents, *n* (%)†
Community-wide training	
Hospital participated in community-wide training from 2001 to present	453 (78.8)
Method of training‡§	
Internet-based	113 (7.0)
Satellite broadcast	147 (9.1)
Video instruction	201 (12.5)
Classroom session	1196 (74.1)
Non-Internet computer-based	61 (3.8)
Audio conference	106 (6.6)
Other	197 (12.2)
Entity that provided the training‡	
Government administration	646 (40.0)
Health care provider	556 (34.4)
Public health department	491 (30.4)
Public safety organization	340 (21.1)
Professional association	221 (13.7)
Other	211 (13.1)
Community planning group documents participation in the community-wide training	
Yes	461 (80.2)
No	24 (4.2)
Don't know	80 (13.9)
Not applicable	10 (1.74)
Community-wide drills or exercises	
Hospital participated in community-wide drill from 2001 to present	526 (92.4)
Type of drill‡‖	
Tabletop	437 (21.9)
Functional exercise	448 (21.6)
Full exercise	1038 (51.9)
Other	123 (6.2)
Notice of the drill	
Announced	1217 (63.1)
Unannounced drill	707 (36.6)
Both	6 (0.3)
Additional patient volume in drill‡	
Simulated	578 (30.0)
Actual people	1085 (56.3)
Both	80 (4.2)
Not applicable	185 (9.6)
Hospital staff involved in community exercising of the SNS	154 (26.8)
Community IMS	
Community emergency operations plan uses IMS	502 (87.3)
IMS includes joint information center	
Yes	360 (63.2)
No	91 (16.0)
Don't know	118 (20.7)
Not applicable	1 (0.2)
Joint information center has been tested through drills	281 (49.3)
IMS includes emergency operations center	
Yes	527 (92.5)
No	11 (1.9)
Don't know	31 (5.4)
Not applicable	1 (0.2)
Emergency operations center has been tested through drills	469 (82.3)
IMS includes medical operations center	
Yes	268 (47.2)
No	175 (30.8)
Don't know	124 (21.9)
Not applicable	1 (0.2)
Medical operations center has been tested through drills	221 (38.9)
IMS designated where incident management will occur if there is no emergency scene	
Yes	432 (75.3)
No	34 (5.9)
Don't know	107 (18.6)
Not applicable	1 (0.2)
Hospital has defined roles for key staff to integrate in community IMS	460 (80.0)
Communication mechanisms	
Method by which the hospital is notified if the community IMS is activated‡	
Telephone	492 (85.6)
Pager	168 (29.2)
Radio	351 (61.0)
Other	165 (28.7)
Not applicable	16 (2.8)
Entity responsible for coordinating community-wide testing of communication mechanism‡	
Fire department	155 (27.0)
Emergency medical services	195 (33.9)
Emergency management agency	302 (52.5)
Local public health department	115 (20.0)
Community planning group	83 (14.4)
Police department	133 (23.1)
Emergency 911 service	26 (4.5)
Other	89 (15.5)
Don't know	102 (17.7)

* Unweighted estimates based on responding hospitals. IMS = incident management system SNS = Strategic National Stockpile.
† Because of rounding, percentages do not total 100.
‡ Questionnaire allowed respondents to check all options that applied; percentages do not total 100.
§ Total of 1488 training sessions reported.
‖ Total of 1948 individual drills reported.

Appendix Table 3. Linkage Items Related to Ongoing Surveillance, Laboratory Identification, and Resource Reporting*

Variable	Respondents, *n* (%)†
Surveillance	
Hospital has direct link to state Health Alert Network	
Yes	318 (55.6)
No	135 (23.6)
Don't know	119 (20.8)
Community-developed standardized epidemiologic forms	
Yes	312 (54.5)
No	137 (23.9)
Don't know	124 (21.6)
Laboratory identification	
Community plan addresses laboratory testing for category A agents‡	
Anthrax	271 (47.1)
Smallpox	244 (42.4)
Plague	233 (40.5)
Tularemia	229 (39.8)
Botulism	228 (39.7)
Brucellosis	213 (37.0)
Viral hemorrhagic fever	203 (35.3)
Q-fever	196 (34.1)
Plan in development	107 (18.6)
None of the above	42 (7.3)
Don't know	104 (18.1)
No community plan	70 (12.2)
Hospital can request and receive laboratory results around the clock	
Yes	229 (52.3)
No	57 (10.0)
Don't know	123 (21.5)
Not applicable	93 (16.3)
Turnaround time for weekday requests substantially different from weekend and nighttime requests	
Yes	132 (23.1)
No	171 (29.9)
Don't know	172 (30.1)
Not applicable	97 (17.0)
Resource availability reporting during events	
Hospital shares information on the following areas with outside entities‡	
Other health care facilities	
Emergency department capacity	325 (56.5)
Inpatient beds	325 (56.5)
Intensive care unit beds	297 (51.7)
Negative pressure rooms	251 (43.7)
Decontamination capacity	250 (43.5)
Ventilator availability	260 (45.2)
Local or state public health department	
Emergency department capacity	266 (46.3)
Inpatient beds	267 (46.4)
Intensive care unit beds	244 (42.4)
Negative pressure rooms	268 (46.6)
Decontamination capacity	255 (44.4)
Ventilator availability	228 (39.7)
Emergency operations center	
Emergency department capacity	368 (64.0)
Inpatient beds	339 (59.0)
Intensive care unit beds	305 (53.0)
Negative pressure rooms	263 (45.7)
Decontamination capacity	334 (58.1)
Ventilator availability	260 (45.2)
Emergency medical services	
Emergency department capacity	350 (60.9)
Inpatient beds	281 (48.9)
Intensive care unit beds	251 (43.7)
Negative pressure rooms	180 (31.3)
Decontamination capacity	277 (48.2)
Ventilator availability	179 (31.1)

* Unweighted estimates based on responding hospitals.
† Because of rounding, percentages do not total 100.
‡ Questionnaire allowed respondents to check all options that applied; percentages do not total 100.