ORIGINAL RESEARCH

Assessing Hospital Disaster Readiness Over Time at the US Department of Veterans Affairs

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Abstract

Introduction: There have been numerous initiatives by government and private organizations to help hospitals become better prepared for major disasters and public health emergencies. This study reports on efforts by the US Department of Veterans Affairs (VA), Veterans Health Administration, Office of Emergency Management's (OEM) Comprehensive Emergency Management Program (CEMP) to assess the readiness of VA Medical Centers (VAMCs) across the nation.

Hypothesis/Problem: This study conducts descriptive analyses of preparedness assessments of VAMCs and examines change in hospital readiness over time.

Methods: To assess change, quantitative analyses of data from two phases of preparedness assessments (Phase I: 2008-2010; Phase II: 2011-2013) at 137 VAMCs were conducted using 61 unique capabilities assessed during the two phases. The initial five-point Likert-like scale used to rate each capability was collapsed into a dichotomous variable: "not-developed = 0" versus "developed = 1." To describe changes in preparedness over time, four new categories were created from the Phase I and Phase II dichotomous variables: (1) rated developed in both phases; (2) rated not-developed in Phase I but rated developed in Phase II; (3) rated not-developed in both phases; and (4) rated developed in Phase I but rated not- developed in Phase II.

Results: From a total of 61 unique emergency preparedness capabilities, 33 items achieved the desired outcome – they were rated either "developed in both phases" or "became developed" in Phase II for at least 80% of VAMCs. For 14 items, 70%-80% of VAMCs achieved the desired outcome. The remaining 14 items were identified as "low-performing" capabilities, defined as less than 70% of VAMCs achieved the desired outcome.

Conclusion: Measuring emergency management capabilities is a necessary first step to improving those capabilities. Furthermore, assessing hospital readiness over time and creating robust hospital readiness assessment tools can help hospitals make informed decisions regarding allocation of resources to ensure patient safety, provide timely access to high-quality patient care, and identify best practices in emergency management during and after disasters. Moreover, with some minor modifications, this comprehensive, all-hazards-based, hospital preparedness assessment tool could be adapted for use beyond the VA.

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Keywords: assessment; capabilities; disaster readiness; emergency management; hospital preparedness

Abbreviations:
AHRQ: Agency for Healthcare Research and Quality
CEMP: Comprehensive Emergency Management Program
HRSA: Health Resources and Services Administration
MA: Mission Area
MCE: mass-casualty emergency
OEM: VA's Office of Emergency Management
SOP: standard operating procedure
VA: US Department of Veterans Affairs
VAMCs: VA Medical Centers

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Introduction

Achieving and maintaining a high level of emergency preparedness is a major challenge for hospitals because of their role in emergency response. Equally challenging is how to assess hospital emergency readiness. Over the past decade, there have been numerous initiatives and tools developed by The Joint Commission (TJC; Oakbrook Terrace, Illinois USA), the US Department of Homeland Security (DHS; Washington, DC USA), the US Department of Health and Human Services (DHHS; Washington, DC USA), the World Health Organization (WHO; Geneva, Switzerland), and the US Department of Veterans Affairs (VA; Washington, DC USA) to help hospitals become better prepared for major disasters. Approaches to enhance hospitals' emergency preparedness include: continuing education of health care professionals;[1,2] compilation of lessons learned from disaster exercises or emergency drills;[3] implementation of community-focused, emergency preparedness training programs;[4,5] and development of objectively-measured preparedness capabilities.[6,7]

To date, there is limited agreement about what constitutes effective hospital emergency preparedness[8] and no widely-accepted, validated tool for measuring it.[7,9-12] Furthermore, there is considerable variation in the protocols and tools that exist for assessing a hospital's emergency management capabilities.[11,12] Some instruments are more comprehensive, allowing for the measurement of hospital all-hazards preparedness, while a number are hazard-specific, such as a tool to assess the quality of standard operating procedures (SOPs) for pandemic influenza.[13-22] Other instruments are designed with a more specific focus, such as the evaluation of functional exercises,[23] incident command centers,[11] or other elements of preparedness; examples include the Agency for Healthcare Research and Quality (AHRQ; Rockville, Maryland USA) Disaster Drill Evaluation Tool[10,24] and the Association of State and Territorial Health Officials' (ASTHO; Arlington, Virginia USA) National Health Security Preparedness Index.[25]

Often, multiple approaches are employed as part of the same assessment. Assessments frequently start with a pre-site survey during which a hospital's emergency manager is asked to complete a questionnaire that gages staff training and skills as well as the availability of equipment and supplies. Then, during a subsequent site visit, evaluators may use structured questionnaires and checklists to examine key equipment, space, and staff skills.[11,16-22] Hospital preparedness assessments also may include drills or functional exercises to evaluate facility performance during a simulated mass-casualty emergency (MCE).[23-26]

Given the dramatic increase in the frequency and intensity of natural weather-related, technological, infectious disease, and human-caused disaster events during the past decade,[27-29] there is a significant need for reliable and valid methods to measure hospital preparedness capabilities. In recognition of this need, the VA's Office of Emergency Management (OEM; Martinsburg, West Virginia USA) developed and implemented a Comprehensive Emergency Management Program (CEMP) in 2004. The VA CEMP is aimed at ensuring the resiliency, continuity, and rapid recovery of VA health care services and facilities during disasters and other potential disruptions to health care service delivery.[30] The VA is the largest health care system in the United States and has a mission to ensure emergency preparedness to assist veterans and their communities in times of disasters. The VA is divided into 18 geographic regions called Veterans Integrated Services Networks that currently include 152 VA Medical Centers (VAMCs) and 749 Community-based Outpatient Clinics located throughout the United States.

In 2004, the assessment of the VA's level of "all-hazards preparedness" began with a survey of VAMCs using a self-administered hospital preparedness questionnaire modified from a survey tool developed for AHRQ and the Health Resources and Services Administration (HRSA; Rockville, Maryland USA). The VA CEMP program used: (1) findings from this survey; (2) a review of the relevant literature; (3) an examination of pertinent industry and governmental standards and guidelines; and (4) consultations with subject-matter experts to develop protocols and tools to assess each VAMC. The overall design was influenced heavily by the Institute of Medicine's (IOM; Washington, DC USA) report on the Metropolitan Medical Response System.[31] The VA's CEMP assessments began in 2007 with a pilot development phase and were then fully implemented in two successive phases: 2008-2010 ("Phase I") and 2011-2013 ("Phase II"). This article reports descriptive analyses of CEMP hospital assessments in both phases and assesses change in hospital preparedness over time.

Methods

Descriptive analyses of data on the emergency capabilities, or "all-hazards preparedness," for 137 VAMCs were assessed in both phases (Phase I: 2008-2009 and Phase II: 2011-2013) for the CEMP program. The development of the VA's "all-hazards preparedness" assessment tool started in 2004 where data were collected using a modified questionnaire from the AHRQ and the HRSA. Findings from this survey were combined with a review of the relevant literature, an examination of pertinent industry and governmental standards and guidelines, and consultations with subject-matter experts to develop VA-sponsored protocols and tools designed to assess CEMP at each VAMC. During each phase, data were collected by a team of experts who travelled to each VAMC and assessed each hospital's emergency readiness through observation, demonstration, document review, and interviews with key staff. The team of experts who conducted the site visits consisted of: a team leader, who had a hospital director/administration background; a health care system engineer; a physician; a nurse; and a health care system emergency manager. Most of these individuals were former VA employees contracted with for this purpose. Training of the assessors was conducted in 2008 and as new staff joined the cadre. The team leader was responsible for ensuring assessors understood their role and the assessment process. For detailed discussion on the development of the assessment tools and the process of data collection for the two phases, see the authors' related article, in press.[32]

The CEMP assessment included six critical Mission Areas (MAs) as essential components: Program Management; Incident Management; Safety and Security; Resiliency and Continuity; Medical Surge; and Support to External Requirements (Table 1). Each MA included a set number of emergency preparedness capabilities. A five-point Likert-like scale (5 = exemplary, 4 = excellent, 3 = developed, 2 = being developed, and 1 = needs attention) was used initially to indicate the final score for each capability, but was collapsed into a dichotomous variable for the current analysis of readiness and readiness changes over time: not-developed = 0 (being developed or needs attention) versus developed = 1 (exemplary, excellent, or developed). Since VA leadership is interested in knowing which capabilities are at least developed compared to those that are not, the three categories

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Mission Area (MA)	Mission Description
Program Management (MA 1)	Development, implementation, and maintenance of emergency management programs (ie, the organization and structure of the CEMP, including funding, leadership support, personnel training, reporting evaluation, and goal creation).
Incident Management (MA 2)	Processes and procedures for incident recognition and mobilization of critical staff and equipment (including information exchange, incident recognition, assets mobilization, and demobilization).
Safety and Security (MA 3)	Processes and procedures for evacuation and/or shelter-in-place and managing hazardous substance incident (including aspects that were deemed to be critical to maintaining the safety and security of infrastructure and personnel, patients, and visitors).
Resiliency and Continuity (MA 4)	Resiliency in personnel, critical systems, health care service, and communications (including the ability to maintain mission-critical systems such as heating, ventilation, and air conditioning; electrical power; and potable water; as well as the ability to maintain the resiliency of clinical programs).
Medical Surge (MA 5)	Processes and procedures for expansion of staff for response and recovery (including the ability to ramp up the capacity and capability of critical supplies, equipment, and personnel).
Support to External Requirements (MA 6)	Response and interface with state and community emergency management authorities (including VA's participation in the National Disaster Medical System [NDMS] and similar obligations to other organizations under federal law).

Table 1. Detailed Description of Six CEMP Mission Areas[32]
Abbreviations: CEMP, Comprehensive Emergency Management Program; MA, Mission Area; VA, Veterans Affairs.

of "developed," "exemplary," and "excellent" were collapsed as one single category and the categories of "not developed" and "needs attention" as the other category, indicating that improvement or development of that specific capability was needed. This allowed the research team to assess the relative percentage of facilities that were meeting the capability standards compared to those that were not.

The sample and items for the present analysis included 137 VAMCs and 61 unique capabilities. While the CEMP assessment largely covered the same items and hospitals in both phases, there were some differences in the sample and items. Two VAMCs were assessed in Phase I, but not in Phase II, and three VAMCs were assessed in Phase II, but not in Phase I. The number of capabilities that were assessed in each phase and the number of capabilities that were assessed in both phases are presented in Table 2. In total, 69 capabilities were assessed in Phase I, 71 were assessed in Phase II, and 65 capabilities were assessed in both phases. However, four capabilities had missing assessment data for more than 50% of VAMCs; these capabilities assessed systems or processes that were not applicable to all VAMCs. Even though the majority of capabilities apply to all VAMCs, not all VAMCs are the same in level of complexity, setting, and role. For example, rural VAMCs have fire departments whereas urban VAMCs do not. The data analysis, therefore, included 61 capabilities (Table 2) that were applicable to all 137 assessed VAMCs.

To describe changes in preparedness over time, four categories were used. A new variable was created from the two (Phase I and Phase II) dichotomous variables: (1) rated "developed" in both phases (no change/stayed developed); (2) rated "not-developed" in Phase I but rated "developed" in Phase II (improved/became developed); (3) rated "not-developed" in both phases (no change/never developed); and (4) rated "developed" in Phase I but rated "not-developed" in Phase II (worsened/became undeveloped). The results are displayed in tabular format as well as graphically (Figures 1A through 1F) for each MA. It is important to note that in this case, "developed" meant the specific capability either met or went above and beyond the required industry standards.

Results

The data analysis illustrated the four ratings of change (or no change) in hospital preparedness between the two phases. For each capability in each MA, Figures 1A through 1F graphically display the detailed breakdown of percentage of VAMCs for the four categories of change between Phase I and Phase II: (1) stayed developed (desired outcome); (2) became developed (desired outcome); (3) never developed (undesired outcome); and (4) declined from developed to not-developed (undesired outcome). Table 3 summarizes the findings into three columns illustrating the number of capabilities by percent of VAMCs for the combined two desired outcomes: 80%+, 70%-80%, and <70% of VAMCs stayed or became developed. The 70%-80% criterion was selected since it was the range of median scores for the percent distributions of all 61 capabilities across all 137 VAMCs.

For 33 of the 61 capabilities, 80% or more of VAMCs were rated either developed in both phases or became developed in Phase II. For 14 capabilities, 70%-80% of VAMCs were rated developed in both phases or became developed in Phase II. The remaining 14 capabilities were identified as "low-performing," defined as less than 70% of VAMCs achieved the desired outcomes (see Table 3).

Tables 4A through 4F further illustrate the data for each capability by MA. For each table, the low-performing capabilities are listed in the last column. For Program Management (MA 1 – Table 4A), three low-performing capabilities were identified: capability 1.5 (Incorporation of Comprehensive Mitigation Planning into the Facility's Emergency Management Program); 1.7 (Incorporation of Continuity Planning into the Activities of the Facility's Emergency Management Program to Ensure Organizational Continuity and Resiliency of Mission Critical Functions, Processes, and Systems); and 1.11 (Incorporation of a Range of Exercise Types that Test the Facility's Emergency Management Program). For Incident Management (MA 2 –Table 4B), one item 2.1.4 (Management of Extended Incident Operations) was identified as low-performing. For Safety and Security (MA 3 – Table 4C), there were four low-performing capabilities: 3.1.2 (Processes and Procedures for Sheltering-in-Place); 3.1.3

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Mission Area (MA)	Phase I	Phase II	Phase I & II	Excluded from Analysis for Missing Data	Included in Data Analysis
MA 1	13	14	13	1	12
MA 2	9	9	8	0	8
MA 3	9	10	9	1	8
MA 4.1	12	12	12	0	12
MA 4.2	4	4	4	1	3
MA 4.3	8	8	8	0	8
MA 5	9	8	8	0	8
MA 6	5	6	3	1	2
Total	**69**	**71**	**65**	**4**	**61**

Table 2. Number of Capabilities Included in Each Phase and in the Analysis

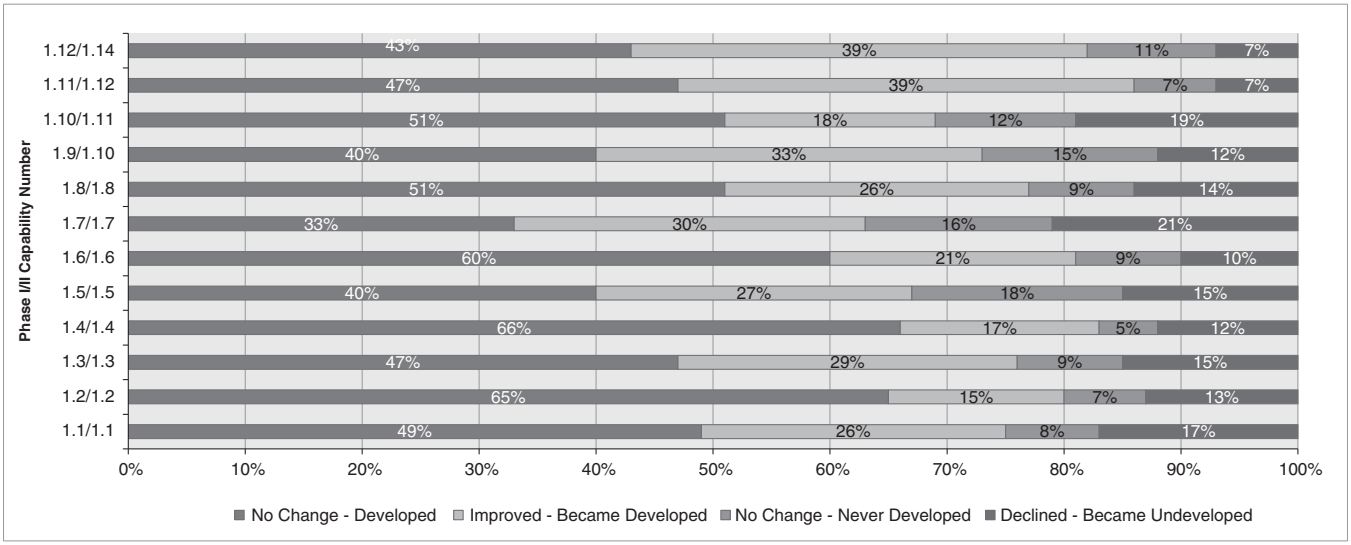

Figure 1A. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 1 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

(Processes and Procedures for Sheltering Family of Critical Staff); 3.3 (Processes and Procedures for Managing a Hazardous Substance Incident); and 3.4.3 (Processes and Procedures for Staff and Family Mass Prophylaxis during an Infectious Outbreak [ie, Influenza]). For Resiliency and Continuity (MA 4 – Table 4D), the three low-performing capabilities were: 4.2.4 (Development, Implementation, Management, and Maintenance of an Emergency Water Conservation Plan); 4.2.6 (Maintaining Sewage and Waste Resiliency); and 4.1.1 (Transporting Critical Staff to the Facility during an Emergency). For Medical Surge (MA 5 – Table 4E), capabilities 5.2 (Management of External Volunteers and Donations during Emergencies), 5.3.4 (Integration of Patient Reception, Surge, and Decontamination Teams), and 5.3.6 (Processes and Procedures for Control and Coordination of Mass Fatality Management) were identified as low-performing capabilities. There were no low-performing capabilities identified for Support to External Requirements (MA 6 – Table 4F).

Discussion

To date, there is no clear consensus how to assess hospital preparedness. A number of challenges around comparing readiness across facilities have been discussed in the literature, including the lack of consistent standards to ensure different institutions are reporting equivalent measures.[18] Moreover, there is a dearth of published data on the impact of hospital preparedness on actual hospital performance during MCEs, or the appropriateness of mitigation and preparedness structures and processes on actual evacuations or efforts to shelter-in-place. Several researchers have recommended that hospitals adopt a more general all-hazards approach in their preparedness plans, supplemented with

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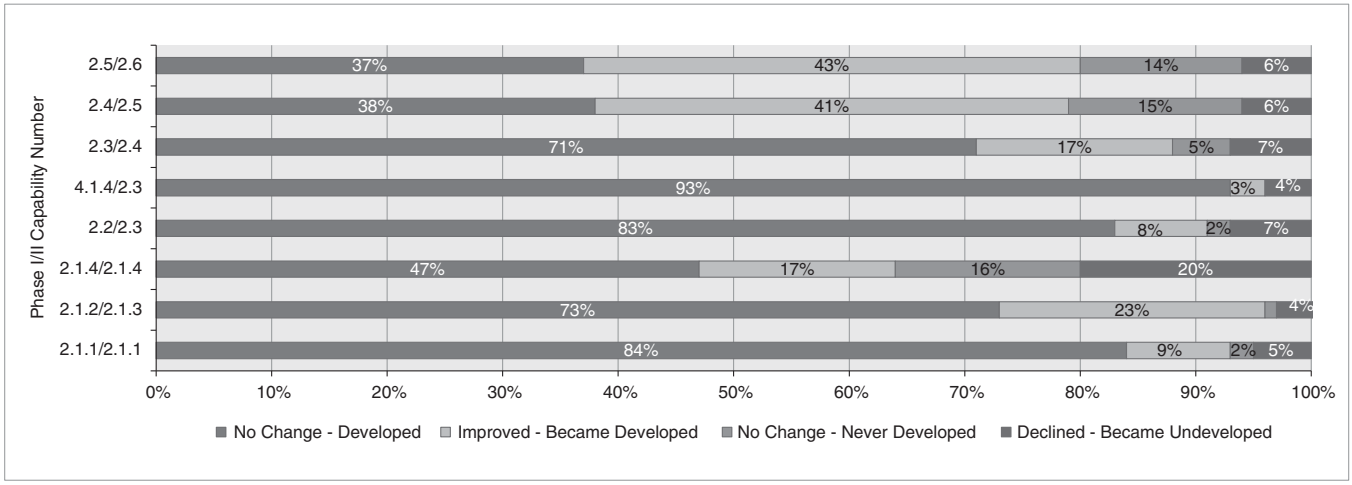

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Figure 1B. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 2 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

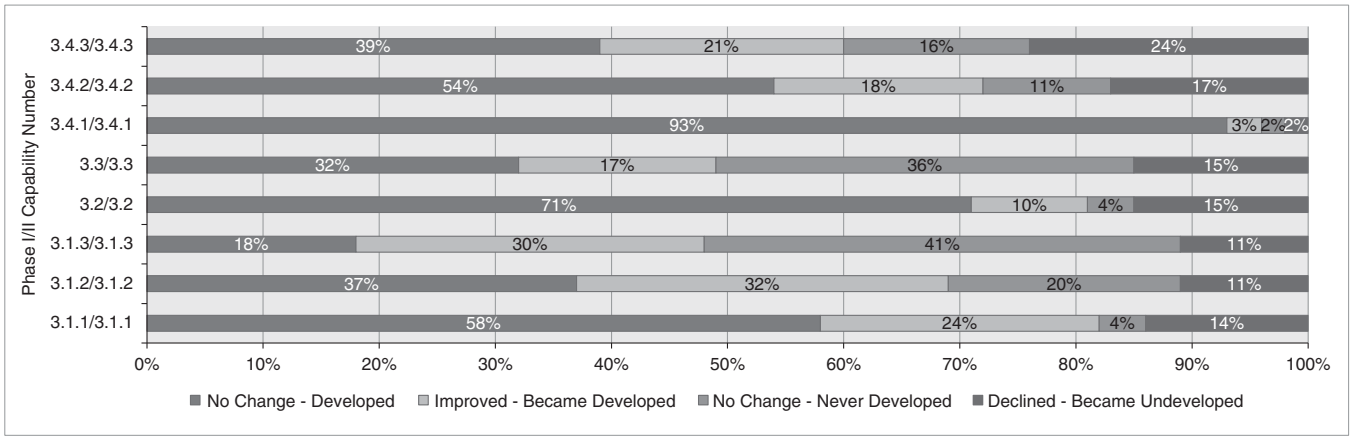

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Figure 1C. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 3 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

hazard-specific elements that account for facility-specific challenges (eg, decontamination and isolation).[7,8,15] The VA's adaptable, all-hazards-based approach used in the CEMP process could serve as a potential model for hospitals outside of the VA because it would address these limitations. Even if health care personnel are trained, the SOPs for a generic emergency scenario could help them handle other emergencies.[9]

The quantitative analyses of the two phases of CEMP data indicate an overall improvement in the level of hospital preparedness for each capability. These improvements might be due to lessons learned from Phase I recommendations, technical assistance and support provided by the OEM, or heightened awareness of what to expect during the second round of assessments. Regardless of the cause, the improvements represent improved preparedness in areas deemed critical for hospitals by emergency management practitioners and other experts.

The observed improvements underscore the importance of measurement because assessing these capabilities likely contributed to the observed improvements in preparedness between Phase I and Phase II. Measuring emergency preparedness in hospitals can lead to improvements by: (1) preventing the overuse, underuse, and misuse of resources for preparedness and response, and ensuring patient safety during and after disasters; (2) identifying what practices do and do not work in emergency management to drive improvement; (3) holding hospitals accountable for providing timely access to high-quality patient care during and after disasters; and (4) measuring and addressing disparities in how care is delivered during and after disasters.

These findings identified "low-performing" capabilities for 14 items, ranging from zero to three capabilities per MA (Tables 4A-4F). Various reasons may explain why some capabilities did not have the desired outcome. For some items, the expectations, standards, or guidelines were not fully developed at the time of the assessment. For example, item 4.2.6 (Maintaining Waste & Sewage Resiliency) was "low-performing" because space was not available at some facilities to provide complete back-up capability to maintain waste and sewage. Item 4.1.1 (Transporting Critical Staff to the Facility during Emergencies) also was recognized as a low-performing capability; as

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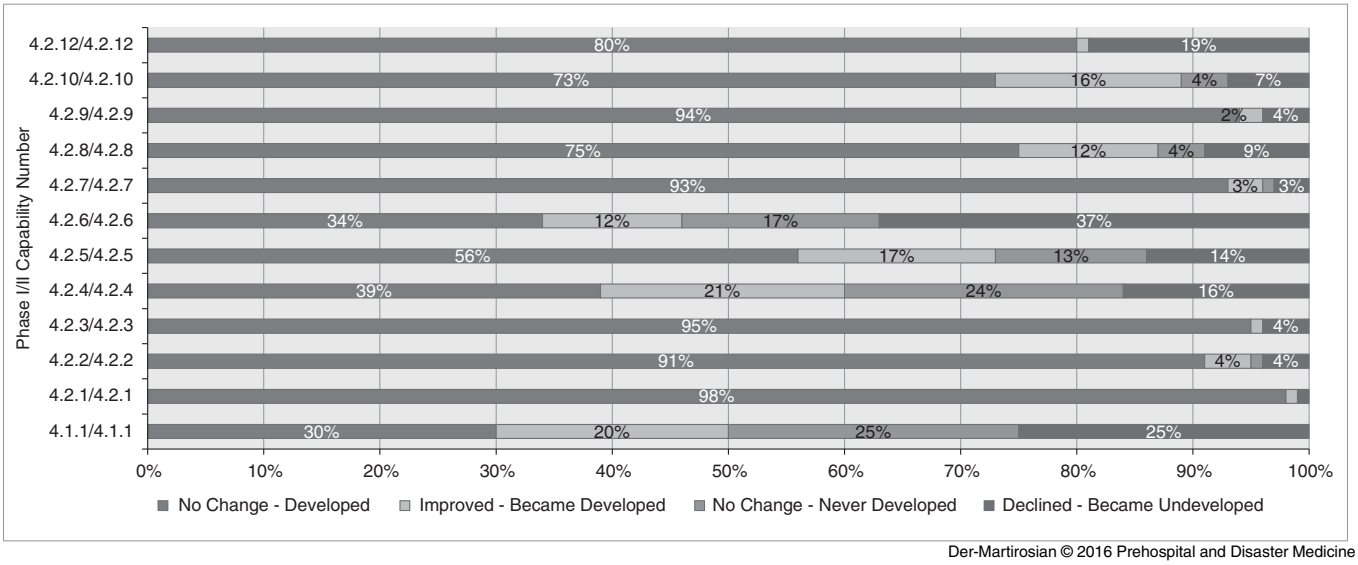

Figure 1D-1. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 4.1 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

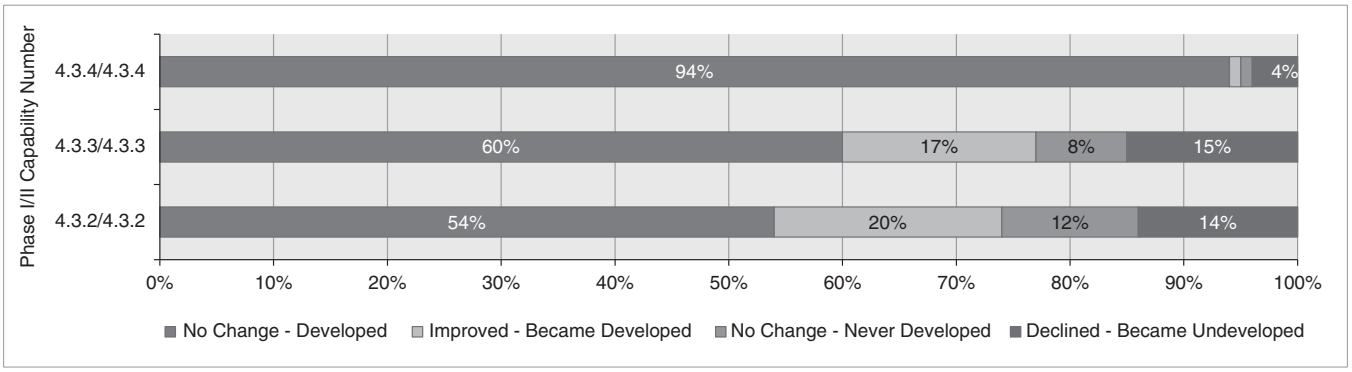

Figure 1D-2. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 4.2 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

such, there have been efforts by VA leadership since the Phase II assessments to better publicize under what circumstances government vehicles may be used to transport staff during emergencies. Similarly, for item 2.1.4 (Management of Extended Incident Operations), efforts at some VAMCs had historically focused on the management of incidents in the short-term rather than long-term. Fully addressing this capability will require additional investments in facilities for space, training of leadership staff on the use of the Incident Command System, and awareness of the requirements of "proxy events" as part of exercise scenarios. Finally, two Program Management (MA 1) capabilities (1.7 and 1.11) were identified as areas that would require additional resources to improve performance. Other "low-performing" capabilities are receiving similar attention and review by the VA to determine remedies or steps for improvement. Furthermore, this "low-performing" capabilities analysis was used by OEM as part of its decision-making process when determining whether to approve requests from VAMCs for funds to make improvements in preparedness.

In addition to helping facilities identify areas of concern, these assessments exposed non-emergency management staff and hospital leadership to emergency management issues, and highlighted that emergency management is both a collaborative process and a shared responsibility. With regard to specific capabilities, there were items over which emergency managers had direct control (eg, alerting and warning systems, incident command, coordination and communications, and overall program structure and management) and there were others over which they had little direct control (eg, infrastructure resiliency, medical surge, on-site fire departments, research centers, access to cash, and home health care) and involved coordination with other departments within the facility or with outside community partners. This distinction highlights the importance of collaboration between different departments within a facility, as well as between the facility and outside agencies. These processes and relationships need to be established well in advance of an event to minimize disruptions to care.

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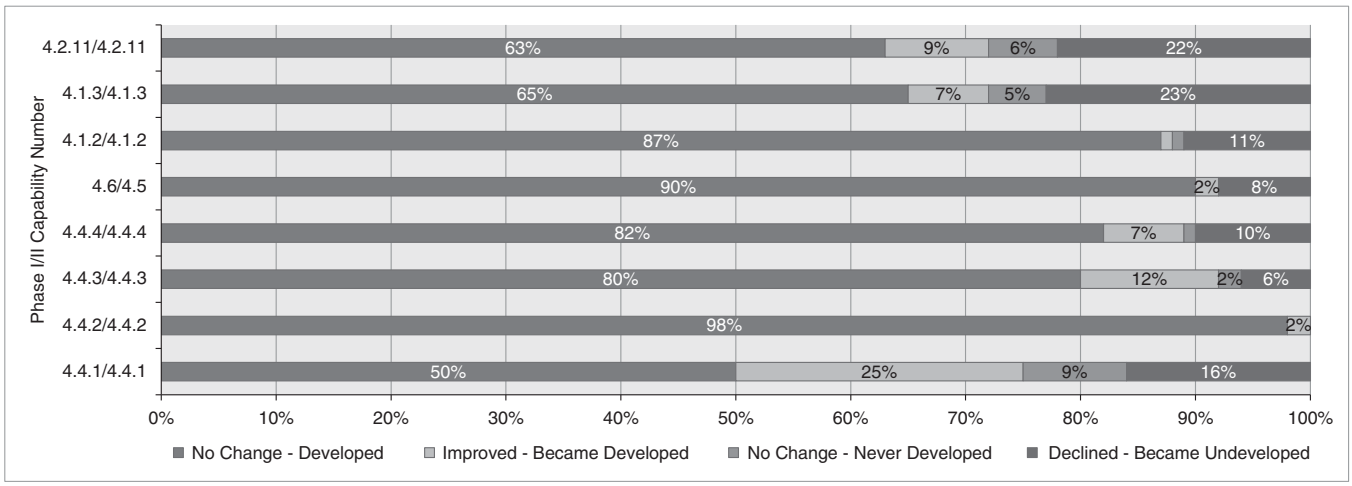

Figure 1D-3. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 4.3 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

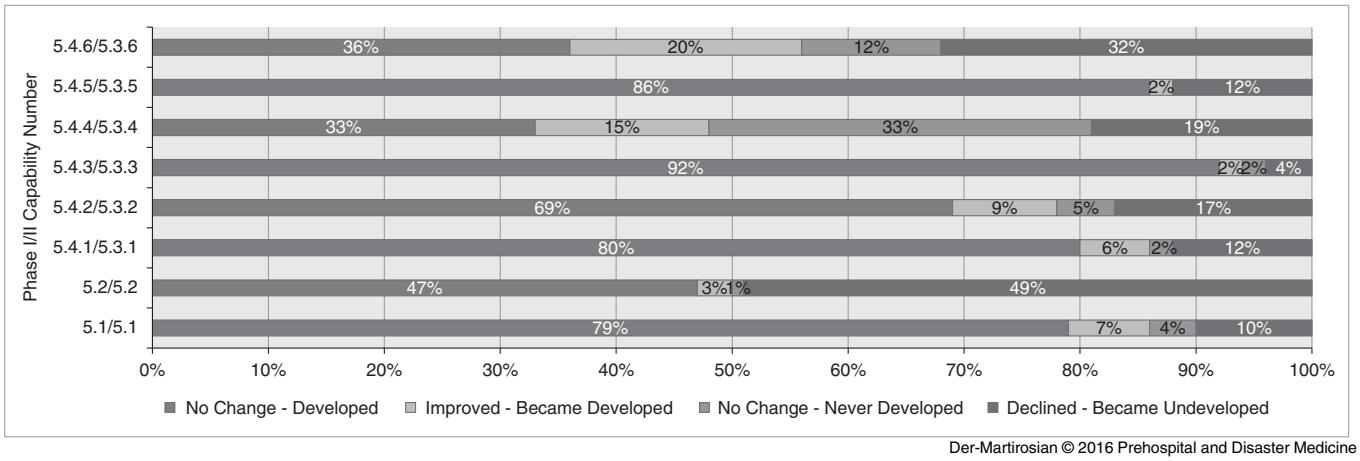

Figure 1E. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 5 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

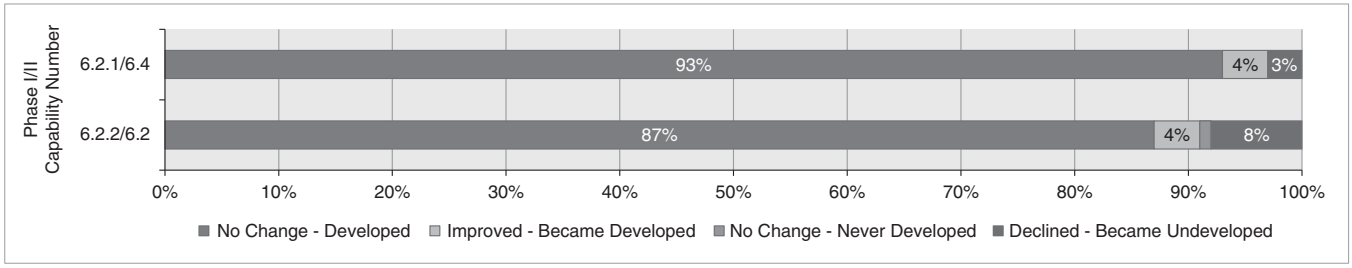

Figure 1F. Percent of VAMCs Developed, Became Developed, Never Developed, and Became Undeveloped Between Two Phases for MA 6 Capabilities.
Abbreviations: MA, Mission Area; VAMC, Veterans Affairs Medical Center.

Limitations/Future Assessments

The study had limitations. First, the tool has not been rigorously validated or thoroughly tested for reliability. Given the substantial input from content experts, including health system emergency managers, emergency physicians and nurses, engineers, infection control practitioners, safety officers, and leadership during its development, the VA CEMP hospital assessment tool has face validity and construct validity.[32] The tool also appears to have some degree of reliability because the modifications between the two phases were relatively minor and VAMCs had consistent

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61 Total Capabilities	80% + of VAMCs (Stayed or Became Developed)	70%-80% of VAMCs (Stayed or Became Developed)	<70% of VAMCs (Stayed or Became Developed)
Number of Capabilities	33 (high performing)	14 (medium performing)	14 (low performing)

Table 3. Number of Capabilities by Percent of VAMCs for Two Desired Outcomes (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

Capability # Phase I/ Phase II	Mission Area 1 (MA-1): Program Level	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	< 70% of VAMCs (Stayed/ Became Developed)
1.1/1.1	Systems-based Approach to the Development, Implementation, Management, and Maintenance of the Emergency Management Program		x	
1.2/1.2	Administrative Activities Ensure the Emergency Management Program Meets its Mission and Objectives	x		
1.3/1.3	Development, Implementation, Management, and Maintenance of an Emergency Management Committee Process to Support the Emergency Management Program		x	
1.4/1.4	Development, Implementation, and Maintenance of a Hazard Vulnerability Analysis Process as the Foundation for Conducting the Emergency Management Program	x		
1.5/1.5	Incorporation of Comprehensive Mitigation Planning into the Facility's Emergency Management Program			x
1.6/1.6	Incorporation of Preparedness Planning into the Facility's Comprehensive Emergency Management Program	x		
1.7/1.7	Incorporation of Continuity Planning into the Activities of the Facility's Emergency Management Program to Ensure Organizational Continuity and Resiliency of Mission Critical Functions, Processes, and Systems			x
1.8/1.8	Development, Implementation, Management, and Maintenance of an Emergency Operations Plan		x	
1.9/1.10	Incorporation of Comprehensive Instructional Activity into the Preparedness Activities of the Facility's Emergency Management Program		x	
1.10/1.11	Incorporation of a Range of Exercise Types that Test the Facility's Emergency Management Program			x
1.11/1.12	Demonstration of Systems-based Evaluation of the Facility's Overall Emergency Management Program and its Emergency Operations Plan	x		
1.12/1.14	Incorporation of Accepted Improvement Recommendations into the Emergency Management Program and its Components such that the Process Becomes One of a Learning Organization	x		

Table 4A. Mission Area 1 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

overall ratings between the two phases. However, the reliability of the tool cannot be assessed fully because inter-rater reliability among assessors was not evaluated systematically. It should be noted that the assessors did participate in the same trainings prior to assessing the VAMCs. Finally, although detailed guidelines were developed for the scoring rubric, assessors sometimes relied on achieving consensus for determining the final score for some capabilities. This process may have inappropriately introduced

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Capability # Phase I/ Phase II	Mission Area 2 (MA-2): Incident Management	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	<70% of VAMCs (Stayed/ Became Developed)
2.1.1/2.1.1	Processes and Procedures for Incident Recognition, Activation of the Emergency Operations Plan, Emergency Operations Center, and Initial Notification	x		
2.1.2/2.1.3	Mobilization of Critical Staff and Equipment for Incident Response	x		
2.1.4/2.1.4	Management of Extended Incident Operations			x
2.2/2.2	Public Information Management Services During an Incident	x		
4.1.4/2.3	Dissemination of Personnel Incident Information to Staff During an Incident	x		
2.3/2.4	Management and Acquisition of Resources for Incident Response and Recovery Operations	x		
2.4/2.5	Processes and Procedures for Demobilization of Personnel and Equipment		x	
2.5/2.6	Processes and Procedures for a Return to Readiness of Staff and Equipment		x	

Table 4B. Mission Area 2 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

Capability # Phase I/Phase II	Mission Area 3 (MA-3): Occupant Safety	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	<70% of VAMCs (Stayed/ Became Developed)
3.1.1/3.1.1	Processes and Procedures for Evacuation of Patients, Staff, and Visitors	x		
3.1.2/3.1.2	Processes and Procedures for Sheltering-in-Place			x
3.1.3/3.1.3	Processes and Procedures for Sheltering Family of Critical Staff			x
3.2/3.2	Perimeter Management of Access and Egress to Facility During an Incident (eg, Lockdown)	x		
3.3/3.3	Processes and Procedures for Managing a Hazardous Substance Incident			x
3.4.1/3.4.1	Biohazard (Infection) Control Surge Services During Emergencies	x		
3.4.2/3.4.2	Selection and Use of Personal Protective Equipment for Incident Response and Recovery Operations		x	
3.4.3/3.4.3	Processes and Procedures for Staff and Family Mass Prophylaxis During an Infectious Outbreak (ie, Influenza)			x

Table 4C. Mission Area 3 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

subjectivity into the scoring process, though there is no information to determine the extent to which this occurred or whether the scores would be systematically higher or lower without consensus scoring.

Although subsets of the 61 assessed capabilities (eg, support to external missions) are not applicable to non-VA facilities, most capabilities should be applicable to non-VA facilities. Ideally, assessments of facility preparedness would go beyond system and

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Capability # Phase I/ Phase II	Mission Area 4 (MA-4): Resiliency and Continuity Operations	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	<70% of VAMCs (Stayed/ Became Developed)
	4.1 Mission Critical Systems Resiliency			
4.2.1/4.2.1	Development, Implementation, Management, and Maintenance of an Electrical Power System	x		
4.2.2/4.2.2	Management and Maintenance of Fixed and Portable Electrical Generator Resiliency	x		
4.2.3/4.2.3	Maintaining Fuel, Fuel Storage, and Fuel Pumps for Generators, Heating, and Vehicles Resiliency	x		
4.2.4/4.2.4	Development, Implementation, Management, and Maintenance of an Emergency Water Conservation Plan			x
4.2.5/4.2.5	Maintaining Emergency Potable Water System Resiliency		x	
4.2.6/4.2.6	Maintaining Sewage and Waste Resiliency			x
4.2.7/4.2.7	Maintaining Medical Gases and Vacuum Resiliency	x		
4.2.8/4.2.8	Maintaining Heating Ventilation and Air Conditioning Resiliency	x		
4.2.9/4.2.9	Maintaining Information Technology and Computing Resiliency	x		
4.2.10/4.2.10	Maintaining Access to Critical Commodities and Services During Response and Recovery Operations	x		
4.2.12/4.2.12	Cash to Purchase Supplies and Services During an Emergency	x		
4.1.1/4.1.1	Transporting Critical Staff to the Facility during an Emergency			x
	4.2 Communications			
4.3.2/4.3.2	Maintaining Satellite Telephone Resiliency		x	
4.3.3/4.3.3	Interoperable Communications with External Agencies		x	
4.3.4/4.3.4	Interoperable Communications with Veterans Affairs Medical Center Facilities	x		
	4.3 Health Care Service System Resiliency			
4.4.1/4.4.1	Development, Implementation, Management, and Maintenance of Community-based Outpatient Clinic Emergency Operations Plan		x	
4.4.2/4.4.2	Management of Care for Home-Based Primary Care Patients during Incidents	x		
4.4.3/4.4.3	Specialty Outpatient Services (eg, Dialysis, Persons with Spinal Cord Injury Dependent on Community/Outside Assistance in the Home, Oxygen Therapy Patients, and Dementia or Other Cognitive Impairment)	x		
4.4.4/4.4.4	Provision of Ambulatory Clinical Services during Incidents	x		
4.6/4.5	Maintaining Patient Mental Health and Welfare	x		
4.1.2/4.1.2	Maintaining Authorized Leadership (Leadership Succession)	x		
4.1.3/4.1.3	Processes and Procedures for Personal Preparedness and Employee Welfare		x	
4.2.11/4.2.11	Internal and External (to Veterans Affairs) Alternate Care Sites		x	

Table 4D. Mission Area 4.1, 4.2, 4.3 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

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Capability # Phase I/Phase II	Mission Area 5 (MA-5): Medical Surge	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	<70% of VAMCs (Stayed/ Became Developed)
5.1/5.1	Processes and Procedures for Expansion of Staff for Response and Recovery Operations	x		
5.2/5.2	Management of External Volunteers and Donations During Emergencies			x
5.4.1/5.3.1	Development, Implementation, Management, and Maintenance of the Veterans Affairs All-Hazards Emergency Cache	x		
5.4.2/5.3.2	Designated Capability for Expanded Patient Triage, Evaluation, and Treatment during Surge		x	
5.4.3/5.3.3	Designation and Operation of Isolation Rooms	x		
5.4.4/5.3.4	Integration of Patient Reception, Surge, and Decontamination Teams			x
5.4.5/5.3.5	Maintaining Laboratory, Blood Bank, and Diagnostic Imaging Surge Capability	x		
5.4.6/5.3.6	Processes and Procedures for Control and Coordination of Mass Fatality Management			x

Table 4E. Mission Area 5 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

Capability # Phase I/Phase II	Mission Area 6 (MA-6): Support to External Requirements	80% + of VAMCs (Stayed/ Became Developed)	70%-80% of VAMCs (Stayed/ Became Developed)	<70% of VAMCs (Stayed/ Became Developed)
6.2.1/6.4	Response and Interface with State and Community Emergency Management Authorities and State and Local Public Health	x		
6.2.2/6.2	Response and Interface with Community Healthcare Organizations	x		

Table 4F. Mission Area 6 Capabilities - Percent of VAMCs with Desired Outcome (Stayed/Became Developed)
Abbreviation: VAMC, Veterans Affairs Medical Center.

process measures and also link assessments to outcome measures. However, due to the uncommon and often unique nature of disasters, it may be difficult or impossible to establish such linkages. Accordingly, assessing performance during exercises and drills may be the best alternative. It is possible that large, integrated delivery systems like the VA may be able to assess outcomes in some areas.[30]

It also should be noted that the degree to which a hospital is prepared for emergencies is dependent on several key factors, including the availability and flexibility of financial and human resources, organizational location, frequency of past emergencies and threat of seasonal emergencies, and overall organizational culture. The relationship between organizational culture and operational decisions has been the subject of studies by medical sociologists, providing evidence on the relationship between organizational culture and performance in a hospital setting[33] which can be extended to how hospitals perform during major emergencies. The VA recognizes the value of emergency preparedness, evidenced through the VA Strategic Plan, Goal 3, Objective 3.5: *Ensure preparedness to provide services and protect people and assets continuously and in time of crisis*. This assessment process was designed to provide a formative assessment for VAMCs to use in improving their comprehensive emergency management programs, and by leadership to better understand the current status and strategic requirements for preparedness of the VA health care system.[34] The VA began to collect data for Phase III of the assessment program in 2015, which will continue the process and program to assess hospital response capabilities. Before Phase III of the CEMP assessment was fielded, the metrics and processes from earlier phases were evaluated critically and refined. As such, the program has been able to improve the assessment tool and processes in a dynamic framework. The all-hazards-based tool used to assess hospital preparedness in this study was derived from generally accepted standards and, with

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some modification, could be adapted for non-VA hospitals. The need for such a tool is particularly apparent at a time when the Centers for Medicare and Medicaid Services (CMS; Baltimore, Maryland USA) has issued a rule to enact new preparedness requirements on Medicare- and Medicaid-participating health care providers, including hospitals.[35]

Conclusion

These findings from quantitative analysis of CEMP assessments for two phases indicated an overall improvement in hospital preparedness scores over time, which reinforces the value of conducting such assessments. The lack of consensus on how to measure hospital preparedness remains problematic since there are no consistent standards that can be applied to all hospitals to ensure different institutions are reporting equivalent measures. More studies are needed to create valid and reliable measures that can be applied to all hospitals, but the CEMP offers one model that has been implemented and refined for use in VA facilities with potential applicability to non-VA hospitals.

References

1. Sauer LM, McCarthy ML, Knebel A, Brewster P. Major influences on hospital emergency management and disaster preparedness. *Disaster Med Public Health Prep*. 2009;3(1Suppl):S68-S73.
2. Buyman A, Dubruiel N, Torghele K, Alperin M, Miner KR. Can summits lead to curricula change? An evaluation of emergency preparedness summits of schools of nursing in Georgia. *J Contin Educ Nurs*. 2009;40(5):210-215.
3. Ferrer RR, Ramirez M, Sauser K, Iverson E, Upperman JS. Emergency drills and exercises in health care organizations: assessment of pediatric population involvement using after-action reports. *Am J Disaster Med*. 2009;4(1):23-32.
4. Levy LA, Rokusk CF, Bragg SM, Howell JT. Interdisciplinary approach to all-hazards preparedness: are you ready? How do we know? *J Public Health Manag Pract*. 2009;15 (2Suppl):S8-S12.
5. Wang C, Wei S, Xiang H, et al. Development and evaluation of a leadership training program for public health emergency response: results from a Chinese study. *BMC Public Health*. 2008;8:377.
6. Barbera JA, Yeatts DJ, Macintyre AG. Challenge of hospital emergency preparedness: analysis and recommendations. *Disaster Med Public Health Prep*. 2009;3(2Suppl): S74-S82.
7. Adini B, Laor D, Cohen R, Zadok R, Bar-Dayan Y. Assessing levels of hospital emergency preparedness. *Prehosp Disaster Med*. 2006;21(6):451-457.
8. Adini B, Godlberg A, Cohen D, Bar-Dayan Y. Evidence-based support for the all-hazards approach to emergency preparedness. *Isr J Health Policy Res*. 2012;1(1):40.
9. Adini B, Laor D, Hornik-Lurie T, Schwartz D, Aharonson-Daniel L. Improving hospital mass casualty preparedness through ongoing readiness evaluation. *Am J of Med Quality*. 2012;27(5):426-433.
10. Kaji A, Langford V, Lewis RJ. Assessing hospital disaster preparedness: a comparison of an on-site survey, directly observed drill performance, and video analysis of teamwork. *Ann Emerg Med*. 2008;52(3):195-201.
11. Jenkins JL, Kelen GD, Sauer LM, Fredericksen KA, McCarthy ML. Review of hospital preparedness instruments for National Incident Management System compliance. *Disaster Med Public Health Prep*. 2009;3(1Suppl):S83-S89.
12. McCarthy ML, Brewster P, Hsu EB, Macintyre AG, Kelen G. Consensus and tools needed to measure health. *Disaster Med Public Health Prep*. 2009;3(1Suppl):S45-S51.
13. Adini B, Goldberg A, Cohen R, Bar-Dayan Y. Relationship between standards of procedures for pandemic flu and level of hospital performance in simulated drills. *Ann Emerg Med*. 2008;52(3):222-229.
14. Kaji AH, Lewis RJ. Hospital disaster preparedness in Los Angeles County. *Academic Emerg Med*. 2006;13(11):1198-1203.
15. Macintyre AG, Barbera JA, Brewster P. Health care emergency management: establishing the science of managing mass casualty and mass effect incidents. *Disaster Med Public Health Prep*. 2009;3(1Suppl):S52-S58.
16. Higgins W, Wainright C, Lu N, Carrico R. Assessing hospital preparedness using an instrument based on the mass casualty disaster plan checklist: results of a statewide survey. *Am J of Infection Control*. 2004;32(6):327-332.
17. Hick J, Koenig K, Barbisch D, Bey T. Surge capacity concepts for health care facilities: the CO-S-TR model for initial incident assessment. *Disaster Med Public Health Prep*. 2008;2(1Suppl):S51-S57.
18. Hick J, Barbera J, Kelen G. Refining surge capacity: conventional, contingency, and crisis capacity. *Disaster Med Public Health Prep*. 2009;3(1Suppl):S59-S67.
19. Hick J, Christian M, Sprung C. Surge capacity and infrastructure. *Intensive Care Med*. 2010;36(1Suppl):S11-S20.
20. Hick J, Hanfling D, Cantrill S. Allocating scarce resources in disasters: emergency department principles. *Ann Emerg Med*. 2012;59(3):177-187.
21. Kaji A, Koenig K, Bey T. Surge capacity for health care systems: a conceptual framework. *Ann Emerg Med*. 2006;13(11):1157-1159.
22. Legemaate GAG, Burkle FM Jr., Bierens JJLM. The evaluation of research methods during disaster exercises: applicability for improving disaster health management. *Prehosp Disaster Med*. 2012;26(6):1-9.
23. Ingrassia P, Prato F, Geddo A, et al. Evaluation of medical management during a mass casualty incident exercise: an objective assessment tool to enhance direct observation. *J Emerg Med*. 2010;39(5):629-636.
24. Kaji A, Lewis R. Assessment of the reliability of the Johns Hopkins/Agency for Healthcare Research and Quality Hospital Disaster Drill Evaluation Tool. *Ann Emerg Med*. 2008;52(3):204-210.
25. Association of State and Territorial Health Officials. The National Health Security Preparedness Index: a new way to measure and advance our nation's preparedness. http://www.nhspi.org/. Accessed July 16, 2014.
26. Barbisch D, Koenig K. Understanding surge capacity: essential elements. *Academic Emerg Med*. 2006;13(11):1098-1102.
27. Webster PJ, Holland GJ, Curry JA, Chang HR. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science*. 2005;309(5742): 1844-1846.
28. Hay J, Mimura N. The changing nature of extreme weather and climate events: risks to sustainable development. *Geomatics, Natural Hazards and Risk*. 2010;1(1): 3-18.
29. United States Agency for International Development (USAID). http://www.usaid.gov/what-we-do/global-health/pandemic-influenza-and-other-emerging-threats. Accessed July 16, 2014.
30. Dobalian A, Callis R, Davey VJ. Evolution of the Veterans Health Administration's role in emergency management since September 11, 2001. *Disaster Med Public Health Prep*. 2011;5(Suppl2):S182-S184.
31. Manning F, Goldfrank L. (eds). *Preparing for Terrorism: Tools for Evaluating the Metropolitan Medical Response System Program*. Washington, DC USA: National Academy of Sciences; 2002.
32. Dobalian A, Stein JA, Radcliff TA, et al. Developing valid measures of emergency management capabilities within US Department of Veterans Affairs Hospitals. *Prehosp Disaster Med*. 2016;31(5):475-484.
33. Jacobs R, Mannion R, Davies HTO, Harrison S, Konteh F, Walshe K. The relationship between organizational culture and performance in acute hospitals. *Social Science Med*. 2013;(76):115-125.
34. United States Department of Veterans Affairs, Veterans Health Administration (VHA). Blueprint of Excellence. VHA 9/21/2014. http://www.va.gov/ HEALTH/docs/VHA_Blueprint_for_Excellence.pdf. Accessed July 16, 2015.
35. Emergency Preparedness Standards for Medicare and Medicaid Participating Providers and Suppliers: A Rule by CMS on 9/16/2016. https://www.federalregister.gov/documents/2016/09/16/2016-21404/medicare-and-medicaid-programs-emergency-preparedness-requirements-for-medicare-and-medicaid. Accessed September 30, 2016.