

Final Progress Report for AHRQ Grant 1R13HS017577-01

Title: Developing Metrics For Measuring Hospital Response Capability For Mass Casualty Incidents

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ABSTRACT

Recent events, such as 9/11 and Hurricanes Katrina and Rita, demonstrated that the U.S. healthcare system is not adequately prepared to deal with mass casualty incidents. No detailed, widely accepted, all-hazards guidance currently exists for hospital emergency management to evaluate their readiness for emergencies. **Purpose and Scope** of this conference was to develop an operational readiness framework that could be used by hospitals to achieve 'all-hazards' readiness through national expert consensus. **Methods:** To do this, the conference organizers held an expert panel meeting of approximately 50 participants over 1.5 days. The experts represented many different organizations and geographic regions and had diverse experience in hospital operations and emergency response. **Results:** The experts reached consensus on a readiness framework that consisted of six dimensions: (1) emergency management program; (2) incident command system; (3) occupant safety and security; (4) continuity of operations; (5) medical surge; and (6) support to external organizations. Within each dimension, the panel members identified many capability elements. The next step is to define the capability elements in objective, measurable terms so that hospitals can use the framework to self-assess their operational readiness for emergencies and disasters.

Key Words: emergency management, hospital readiness, self-assessment

PURPOSE

The purpose of this conference was to convene a group of experts to reach consensus on a framework of hospital operational readiness for all-hazards emergencies and disasters. More specifically, the objectives were to identify the important dimensions and capability-specific elements within each dimension of operational readiness in objective, measurable terms so that hospitals could self-assess their readiness for all-hazards emergencies and disasters.

SCOPE

During the past 15 years, the hospital industry in the U.S. has witnessed markedly increased attention to hospital and healthcare system preparedness for emergencies and disasters. This attention has resulted in funding from various sources, a plethora of guidance documents, many varied training programs, a multitude of businesses offering assistance and advice, countless academic articles, new management models, and the stockpiling of resources. All this has taken place under the objective of preparedness. With this vast commitment of time and effort, however, there is no detailed, widely accepted, and consistent all-hazards guidance that currently exists for hospital emergency management to use to self-assess their readiness for hospital emergencies. Because of recent advances toward this goal (HHS, The Joint Commission, Veterans Health Administration), the organizers of this conference proposed that the development of a detailed, formative readiness framework was now possible. The framework would provide guidance to hospital emergency management professionals that are motivated to achieve 'all-hazards' readiness for emergencies and disasters. To properly develop the framework, the conference organizers convened a national expert panel over a 1.5-day period and charged them with reaching consensus agreement on what constitutes adequate hospital operational readiness.

METHODS

The conference was held at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, on June 24-25, 2008. PL is a not-for-profit, university-affiliated research center with excellent conference facilities and equipment. The conference organizers utilized the Warfare Analysis Laboratory (WAL), which is a specialized facility equipped with 53 laptop computers; an integrated audio and visual infrastructure with six large-screen, high-resolution, interactive, 3D computer graphic display monitors; a designated data-analysis station; and a 50-seat observation gallery. Plans, definitions, and assumptions were displayed on large-screen monitors at the front of the room. Items that needed opinions or to be voted on were processed and displayed in real time. The WAL has a professional team that oversaw the process, and a trained facilitator guided the discussion of key issues and maintained the focus of the conference objectives.

After receiving the award funding, Dr. McCarthy organized a series of conference calls and face-to-face meetings with the conference organizing committee members to plan the expert panel meeting and ensure that the conference grant met its objectives. The conference organizing committee consisted of Melissa McCarthy, Joseph Barbera, Anthony Macintyre, Gabor Kelen, Peter Brewster, Jeffrey Rubin, John Hick, and Lauren Sauer.

The organizing team generated a list of potential panelists according to their expertise and practical experience in emergency preparedness and response. The organizing committee selected professionals that had expertise in many different facets of hospital operations, including clinical (emergency medicine, critical care, trauma, etc.), administrative, engineering, safety and security, mortuary, pharmacy, laboratory, infectious disease control, information systems, legal, and emergency medical services. Table 1 below displays the final list of participants who attended the expert panel meeting. As is evident from Table 1, participants came from diverse geographical regions and represented many different types of organizations and areas of expertise.

Table 1. List of Conference Participants

Name	Title	Institution
Aaron Bair, MD, MSc	Associate Professor, Emergency Medicine	University of California – Davis
Guy Barber, MPH,	Program Manager, Emergency Medicine	Johns Hopkins University
Joseph Barbera, MD	Associate Professor, Engineering	George Washington University
John Beatty, BS	Director Safety and Technical Services	Department of Veterans Affairs
Penny Bevan, MD	Director of Emergency Preparedness	Department of Health, UK
Paul Biddinger, MD	Director of Disaster Medicine	Massachusetts General Hospital
Peter Brewster, BS	Director, Education and Training	Department of Veterans Affairs
Barbara Butcher, MPH	Chief of Staff/Director of Forensics	Chief Medical Examiner, NYC Office
Duane Caneva, MD	Director, Medical Preparedness Policy	Homeland Security Council
Zach Goldfarb, EMT-P	President	Incident Management Solutions Inc.
Lewis Goldfrank, MD	Chair of Emergency Medicine	New York University
Howard Gwon	Disaster Control Administrator	Johns Hopkins University
Mary Ellen Hennessy, RN	Deputy Director	New York State Dept. of Health
John Hick, MD	Medical Director for Preparedness	Hennepin County Medical Center
John Hickey	President	J. M. Hickey and Associates
James Hodge, JD, LLM	Associate Professor, Public Health	Johns Hopkins University
Edbert Hsu, MD	Associate Professor, Emergency Medicine	Johns Hopkins University
J Lee Jenkins, MD	Assistant Professor, Emergency Medicine	Johns Hopkins University
Kelly Johnson, MPH	Coordinator	AHRQ
Gabor Kelen, MD	Chair of Emergency Medicine	Johns Hopkins University
James Kendig	Vice President	Health First, Inc.
Jon Krohmer, MD	Deputy Chief Medical Officer	Department of Homeland Security
CAPT Deborah Levy	Chief, Healthcare Preparedness Activity	CDC
Anthony Macintyre, MD	Associate Professor, Emergency Medicine	George Washington University
CAPT Kevin Mahoney	Captain in US Army	DHHS
Melissa McCarthy, ScD	Associate Professor, Emergency Medicine	Johns Hopkins University
CAPT Laura McNally	Team Leader	DHHS
Dean Morris, CPP	President	Corporate Services Group, LLC
Patricia Needham, MT	Director of Emergency Response	Children's National Medical Center
Beth Neiley, RN, MS	Associate	Booz Allen Hamilton

Name	Title	Institution
Gregg Pane, MD	Deputy Director, OPEO	DHHS
Gregg Parker, MD	Deputy Chief Medical Officer	Department of Veterans Affairs
Davis Patterson, PhD	Research Scientist	Battelle
April Perry, MS	Program Specialist	National Integration Center, DHS
Sally Phillips, RN, PhD	Director of Preparedness Program	AHRQ
James Rieber	Director of EMS	Perham Memorial Hospital
Jeffrey Rubin, BS	Chief, Disaster Medical Services	EMS Authority - California
Lewis Rubinson, MD	Senior Medical Consultant	CDC
Conrad Salinas, MD	Emergency Department Medical Director	Loma Linda Dept. of Veterans Affairs
CDR Melissa Sanders	Team Leader	DHHS
Lauren Sauer, BA	Research coordinator	Johns Hopkins University
James Scheulen, MBA	Chief Administrative Officer, ED	Johns Hopkins University
Roslyne Schulman, MBA	Senior Associate Director	American Hospital Association
Margaret Scott, MD	Chief of Staff	Department of Veterans Affairs
Fuh-Yuan Shih, MD	Assistant Professor, Emergency Medicine	National Taiwan University Hospital
Leslee Stein-Spencer, RN	Manager	Chicago Fire Department
John Stenger, BS, EIT	Director, Healthcare Engineering	Department of Veterans Affairs
Melinda Stibal, MBA, RN	Administrative Director, EMS & Trauma	Memorial Regional Hospital
John Ticehurst, MD	Virologist	Johns Hopkins University
Kevin Vigilante, PhD	Principal	Booz Allen Hamilton
Lissa Westerman, RN	Deputy Coordinator	Arlington County, Emergency Mgmt
Linda Williams, MD	Assistant Chief of Medicine	Arkansas Veterans Healthcare System
Robert Wise, MD	Vice President, Division of Standards	The Joint Commission
Dale Yeatts, MD	Emergency Medicine Fellow	University of Maryland
Kevin Yeskey, MD	Deputy Assistant Secretary	DHHS

The agenda for the conference was as follows:

1. Discuss in depth the draft hospital operational readiness framework.
2. Discuss the value and methodology (types of metrics, methods for measuring against the metrics) in readiness self-assessment by healthcare organizations.
3. Discuss the utility and practicality of using an input, process, output, outcome measures methodology to assess different aspects of hospital operational readiness.
4. Using working groups, review and comment upon the assigned dimension of the hospital operational readiness framework.
5. Using the same working groups, develop a candidate self-assessment methodology using program and performance measures for assessing the assigned dimension.
6. Using the candidate assessment methodology, develop a detailed demonstration example for a narrow element within the working group's assigned dimension. Working groups were asked to define one or two elements by defining input, process, and output performance measures and tying them to presumed outcome measures. These would be used later by the organizing committee to develop metrics from the selected measures.

Dr. Joseph Barbera, Dr. Anthony Macintyre, and Mr. Peter Brewster led the development of a draft hospital operational readiness framework that was sent to all participants approximately 1 week before the expert panel meeting. The starting point for the draft framework was based largely on the Veteran Health Administration (VHA) hospital operational readiness framework, because it was the most consistently and widely applied as well as the best documented at the time. Participants were asked to review the draft framework prior to the meeting. On the first day of the conference, the organizing committee welcomed the participants, provided a brief summary of why a hospital operational readiness framework was needed, reviewed and discussed the draft framework with the participants, and then divided the entire group into six working groups. In the afternoon of the first day, the organizing committee asked each working group to objectively define the domain of operational readiness as well as all important subdomain elements within that dimension. On day two, revisions to the candidate framework were summarized and next steps were identified.

RESULTS

The conference participants defined hospital operational readiness as the ability to effectively maintain hospital operations and sustain a medically safe environment (i.e., healthcare continuity of operations) and adequately address the increased and potentially unusual medical needs of the affected population (i.e., medical surge). Moreover, because being ready for any and all hazards is unattainable, a realistic concept of adequate readiness is the organization's ability to maintain service operations and achieve its response objectives during all high-priority hazard incidents identified in the organization's Hazard Vulnerability Analysis.

The participants reviewed the draft framework and agreed that the following six areas were important dimensions of hospital operational readiness:

- Emergency Management Program
- Emergency Response & Recovery Incident Management Process
- Operations Level Emergency Safety and Security
- Operations Level Continuity of Operations and Organizational Resiliency
- Operations Level Medical Surge Capacity and Capability
- Operations Level External Missions

More detail on each dimension follows. First, an emergency management program is an organized collection of projects, activities, and/or individual plans in an established framework that directs them toward a common goal. The term program implies that regular, ongoing activities are occurring and has a more comprehensive focus than a plan that is a proposed or intended method of getting from one set of circumstances to another. Thus, an emergency management program encompasses all ongoing activities to address surge and resiliency in healthcare.

An emergency operations plan, in contrast, provides specific response guidance. Some of the important elements of an emergency management program that were identified and discussed by the conference participants included an emergency management committee, a hazards vulnerability assessment (HVA), an emergency operations plan, and organizational learning and corrective action processes.

The second important dimension is an Incident Command System (ICS)-based structure and process that is adequate for conducting the organization's incident response and recovery until final recovery operations can be transferred and managed by regular administrative elements. Important elements of this dimension include activation and initial notification, mobilization of the incident management team and key response resources, incident operations, action guidance, demobilization, and recovery activities.

The third important dimension of hospital operational readiness is maintaining a medically and physically safe and secure healthcare facility through the structure, process, and standard operating procedures that guide actions necessary to ensure that this is sustained throughout an incident or, alternatively, to evacuate in an orderly manner to a safe and secure alternate facility. Important elements of this dimension are perimeter management, evacuation versus shelter-in-place determination, emergency hazardous substance control, emergency infection control, emergency fire suppression, and emergency life-safety interface with fire and rescue, EMS, and others.

The fourth dimension includes both continuity of business operations and continuity of healthcare services operations, ensuring the resiliency of the healthcare organization to expected high-risk ('priority') hazards. 'Priority' hazards are based upon a detailed HVA, which should demonstrate an analysis of the organization's critical vulnerabilities in the likely worst-case scenario for each priority hazard. This domain includes many elements of personnel resiliency (i.e., staff capacity, staff health, transportation support) and mission-critical systems resiliency (i.e., electrical power, water, heat and air conditioning, information systems, communication systems, food preparation, medical gases and vacuum, laundry and linen, equipment sterilization systems, business and finance systems, etc.).

One of the discussion points by the conference participants was that most of the attention paid by policymakers has been to medical surge capacity. However, the participants agreed that, without ensuring continuity of operations, there can be no effective surge by a hospital. The fourth dimension of readiness also emphasizes the importance of business continuity in addition to continuity of healthcare services. Healthcare organizations all have requirements related to the business of medicine whether they are for-profit, non-profit, or publicly owned. This can equate to fiscal matters, documentation and record keeping, and other issues. These important activities are clearly addressed and viewed as a distinct continuity area in this dimension of the framework.

The fifth dimension is medical surge capacity and capability, which is the adequacy of the range of resources, process, and procedures necessary to markedly increase either volume of patients (medical surge capacity) and the range of medical problems and patient types (medical surge capability) or both that can be managed by the healthcare organization during emergency response.

Adequate function of this dimension is premised upon the organization having an incident management process that expands the management effectiveness beyond the limitations of everyday hospital management and administration. It also assumes that emergency safety and security and the continuity of operations has been adequately addressed by the organization. Important elements within this dimension include expansion of staffing, equipment and supplies, physical facilities, and healthcare delivery general and specialty services.

The final dimension of hospital operational readiness was support to external organizations. This functional area addresses the adequacy of the resources, process, and procedures necessary to address the healthcare organization's commitment to provide emergency and disaster services to outside organizations. Important elements of this dimension include methods for supporting community emergency responders and for providing contracted medical services for emergency response. This dimension of the framework was the least developed, and conference participants felt that it was critical to expand this dimension because the hospital's integration with community-wide response was viewed as fundamental; individual healthcare facilities do not have sufficient resources to adequately ready themselves without support from the community.

The conference achieved its main objective that was to put forth a well-conceptualized hospital operational readiness framework. It also identified many important capability-specific elements within each dimension of the framework. Future work is needed to define all of the elements as well as how to measure them in objective terms. A framework that describes all elements necessary for effective healthcare emergency management, presented with consistent terminology and formatted to demonstrate the relational nature of each element, is a critical step to provide healthcare facilities with the guidance they need to achieve adequate readiness for all-hazard emergencies and disasters.

PUBLICATIONS

The results of this conference were published in a special issue of the *Journal of Disaster Medicine and Public Health Preparedness* in June 2009, volume 3, supplement 1. A list of the publications in that issue is provided below.(1-10)

- (1) Kelen GD, McCarthy ML. Developing the science of health care emergency preparedness and response. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S2-S3.
- (2) Knebel A, Phillips S. National strategy for health care system preparedness. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S4-S6.
- (3) Bierenbaum AB, Neiley B, Savageau CR. Importance of business continuity in health care. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S7-S9.

- (4) Hodge JG, Garcia AM, Anderson ED, Kaufman T. Emergency legal preparedness for hospitals and health care personnel. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S37-S44.
- (5) McCarthy ML, Brewster P, Hsu EB, MacIntyre AG, Kelen GD. Consensus and tools needed to measure healthcare emergency management capabilities. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S45-S51.
- (6) MacIntyre AG, Barbera JA, Brewster P. Healthcare emergency management: establishing the science of managing mass casualty and mass effect incidents. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S52-S58.
- (7) Hick JL, Barbera JA, Kelen GD. Refining surge capacity: conventional, contingency, and crisis capacity. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S59-S67.
- (8) Sauer LM, McCarthy ML, Knebel A, Brewster P. Major influences on hospital emergency management and disaster preparedness. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S68-S73.
- (9) Barbera JA, Yeatts DJ, MacIntyre AG. Challenge of hospital emergency preparedness: analysis and recommendations. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S74-S82.
- (10) Jenkins JL, Kelen GD, Sauer LM, Frederickson KA, McCarthy ML. Review of hospital preparedness instruments for National Incident Management System compliance. *Journal of Disaster Medicine and Public Health Preparedness* 2009; 3(suppl 1):S83-S89.