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What Should We Learn From Boston?

Arthur L. Kellermann

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**Arthur L. Kellermann^a
The RAND Corporation**

***What Should We Learn From Boston?*^b**

**Before the Committee on Homeland Security and Governmental Affairs
United States Senate**

July 10, 2013

Chairman Carper, Ranking Member Coburn, and distinguished Members of the Committee, thank you for inviting me here today. My name is Dr. Art Kellermann. I am an emergency physician, and hold the Paul O'Neill–Alcoa Chair in Policy Analysis at the RAND Corporation, an independent, non-partisan research organization dedicated to objective analysis.

I appreciate the opportunity to appear before you to discuss the lessons our nation should draw from Boston's response to the marathon bombings. I have more than 25 years' of clinical experience as an academic emergency physician in Seattle, Memphis and Atlanta, where I was part of Grady Memorial Hospital's ER team the night of the Olympic Park Bombing. My remarks will also cover key findings from recent RAND research.

I'm sure you've heard the adage, "It's better to be lucky than good." Boston's responders were both lucky and good.¹ That's why so many victims survived.

At least 6 factors worked to the rescuer's favor:

1. The bombers targeted a major event where large numbers of police, security, and EMS personnel were pre-deployed. This dramatically shortened response times.
2. Because it was race day—and a state holiday—the city's streets weren't choked with traffic. Hospitals were operating at slightly less than maximal capacity.
3. The attack happened shortly before 3pm, hospitals' change of shift. This meant that double the normal complement of health care providers were on-site at every facility.
4. The bombs exploded in the heart of a city that is home to seven trauma centers and several world-class hospitals. Because Boston EMS took care to evenly distribute the casualties, each trauma center received a manageable number of victims.

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5. The 2 relatively low-yield bombs exploded out-of-doors. Typically, closed-space bombings are more severe, because surrounding walls concentrate blast waves.² Lack of structural collapse facilitated the rapid extrication of victims.
6. Lessons learned by our military healthcare providers in Iraq and Afghanistan have started percolating through the US trauma care community – EMS and hospital.

But luck was only part of the reason the death rate was so low; Boston was also good.

Bystanders played a big role in the initial response. Rather than flee the scene, runners tore off their shirts and used them as tourniquets or applied direct pressure to bleeding. Bystanders pulled barriers aside to create access for emergency vehicles, while those with medical training began triaging victims. These courageous civilians were the true “first responders.”

Years before the incident, Boston’s EMS, Fire and police personnel mapped out how they would handle a terrorist bombing. A few years before the Marathon bombings occurred, more than 700 of the City’s prehospital and hospital-based responders learned the basics of blast-injury care at a city-wide “Tales of Our Cities” anti-terrorism conference hosted by (then) Boston EMS director Rich Serino and sponsored by the CDC.³ Speakers from Madrid, London, Mumbai and other global cities that have been targets of terrorism described how their incident unfolded, how they managed the response, and what they’d do differently.⁴ Immediately after the conference, Boston’s officials huddled together to weave what they’d learned into the city’s plan.

Boston’s hospitals did a great job because they *prepared to do a great job*. Every hospital that received casualties had a well-crafted disaster plan that had been exercised prior to the event. Experience has shown, time and again, that a framework of pre-considered action is necessary to ensure a well-organized response. Boston’s healthcare providers reacted swiftly because they knew what they were supposed to do. That’s how disaster plans work.

These observations lead to my most important point:

We cannot assume, based on Boston’s performance, that other U.S. cities are prepared to manage an event of similar or substantially greater magnitude. The fact that Boston’s responders were lucky and good doesn’t mean that the next city will be equally lucky or equally good.

As the horror of September 11, 2001 fades into memory, grant funds for DHS and HHS to strengthen preparedness are dropping and the attention of many local officials and business

leaders has moved elsewhere. Emergency managers and public safety agencies remain focused on the mission, but some hospitals have lapsed into thinking that disaster preparedness is a costly distraction from daily business.

The evidence is all around us:

- Across the country but especially in big hospitals and academic medical centers, emergency departments (EDs) are packed with seriously ill and injured patients who belong in an ICU or hospital ward, but are stuck in the ED because no inpatient beds are available. Every day, hundreds of inbound ambulances are diverted from overcrowded EDs and told to go elsewhere.⁵ Despite substantial evidence that ED crowding harms patients and degrades disaster preparedness, many administrators turn a blind eye.⁶ If you had told me when I joined the first national task force to tackle this problem *more than 20 years ago* that it would be worse today, I would not have believed you. But here we are.
- For many years, preparedness made the annual list of “top ten” issues facing healthcare executives. No longer.⁷ Many hospitals regard disaster drills as a burden they must perform twice a year to satisfy the Joint Commission. This is understandable, because drills cost money, take time, and pull hospital leadership away from other endeavors. To minimize the disruption such drills might otherwise cause, they are typically scheduled well in advance, widely publicized to staff, and held at a time of day –often mid-morning near the end of the week - when the drill will have minimal impact on operations. While such drills are better than nothing, they aren’t run in a manner calculated to identify potential weaknesses so they can be corrected before the real thing happens.⁸
- Hospitals are supposed to serve as community bulwarks during a disaster and focal points for recovery. They shouldn’t become part of the disaster themselves.⁹ But seven years after New Orleans’ Charity Hospital had to be evacuated when its backup generator drowned in the hospital’s basement; two of New York City’s most vital hospitals were disabled when storm surge from Hurricane Sandy submerged critical backup power components in their basements. In Rockaway Park, Queens, a 200-bed nursing home was disabled when storm surge swept inside its first floor and destroyed its backup generator. After more than 24 hours of misery, ambulances arrived to evacuate the facility’s nearly 200 medically fragile patients.
- Hospital administrators juggle many competing priorities, but few are as important as ensuring that your facility will remain functional during a disaster. This requires a systematic assessment of its security, seismic integrity, vulnerability to flooding and storm damage, fire

safety, backup power and other essential considerations. This cannot be ignored. A hospital can muddle along with a short-handed staff and limited supplies for days, but it cannot function without power. Unfortunately, when the time comes to rank capital improvements or approach a wealthy donor, a backup generator rarely makes the list.¹⁰

- Some hospitals don't even respond to requests from state and federal authorities. More than 2 years ago, FEMA, HHS and California state officials asked 200 Southern California hospitals to provide information about their ability to survive a catastrophic earthquake along the southern San Andreas Fault. The hospitals were asked, for example, how many backup generators they have, how much fuel the generators burn, and whether their water tanks are designed to survive an earthquake of the scale predicted along one of our nation's most dangerous faults. Last January, the *Los Angeles Daily News* reported that nearly half of the hospitals FEMA and HHS contacted have not complied with their request.¹¹

This is not where the American people expected us to be after more than a decade of taxpayer investments.

Your letter asked that I address how the federal government's various research and grant programs be better tailored to strengthen emergency preparedness and response. I will first address research, then grant programs:

Research

In 2011-12, RAND conducted a first-ever inventory of non-classified national health security-related research funded by civilian agencies of the federal government.¹² We found that studies on biological threats and bioterrorism dominate the U.S. government's portfolio of health security research. Of the 1,593 research projects we identified, more than one thousand (66 percent) addressed biological threats. Fewer than 10 percent focused on natural disasters such as earthquakes, hurricanes, tornadoes, or floods. Only 4 percent addressed explosives, the method of attack in Boston and the most widely used tool of terrorists around the world.¹³ One reason the federal portfolio is so skewed is that a number of these agencies are working on similar things. Currently, there's no simple way agencies can determine who is funding what, or how the hundreds of studies different agencies are funding each year are adding to our collective knowledge. My team had to manually review each currently-funded study and compile a spreadsheet to conduct our analysis.

We urgently need to develop a more coordinated approach, so we can quickly get answers to important questions. For example, “What are the most effective strategies for managing and allocating scarce resources in a large mass casualty event?” Last year, RAND published the results of an Agency for Healthcare Research and Quality (AHRQ)-sponsored systematic review of the best available evidence on this question.¹⁴ With the exception of research on field triage systems, which don’t perform particularly well, we determined that the number of high-quality studies on any particular strategy is insufficient to either endorse or reject it. That’s not the answer our first responders and hospital providers need to save more lives.

Better measurement tools would help. Earlier this year, in a cover letter to a report on challenges in measuring awardee performance in meeting medical and public health preparedness goals, the GAO noted: “The 2011 and 2012 tornadoes in the Midwest, Hurricanes Sandy in 2012 and Katrina in 2005, the 2009 H1N1 influenza pandemic, and other emergencies have raised concerns about communities’ and states’ abilities to plan, prepare for, and respond to public health threats, whether naturally occurring or man-made. *Of particular concern are questions about the ability of health care systems to “surge”—that is, to have the staff and resources in place to adequately care for increased numbers of affected individuals or individuals with unusual or highly specialized needs.*¹⁵

With the support of the HHS Office of Assistant Secretary for Preparedness and Response (ASPR), RAND recently developed the prototype for a simple but effective hospital “stress test.” It is designed to assess either a single facility or health care coalition’s capability to handle a large surge of patients from a sudden, unexpected MCE such as a major terrorist bombing. It also evaluates how swiftly and completely hospitals perform a series of key actions during the first 90 minutes of a major event. Unlike current disaster drills, it is designed to be conducted on a *no-notice* basis. Much as a bank “stress test” evaluates a financial institution’s strength without disrupting its operations; RAND’s exercise evaluates healthcare institutions without hindering patient care. To date, we’ve run the new exercise in a handful of the nation’s top trauma centers and gotten great feedback. Even highly experienced staff said that the no-notice format was far more challenging, and generated more useful insights, than more costly but scripted drills. Capability measurements like this are needed; not to “catch” underperforming hospitals or communities but to improve everyone’s game.

Grants

Since 9/11, the federal government has invested billions to enhance the preparedness of state and local responders. Have these grants made a measurable difference? The answer is clearly “yes.”

For example, RAND has twice evaluated the Cities Readiness Program; a CDC initiative to prepare cities to distribute medical countermeasures following a bioterrorism attack.^{16,17} Funding provided through this initiative helped communities develop disaster plans, train response personnel to follow those plans, develop protocols and policies to recruit volunteers to supplement trained responders during disasters, and acquire equipment and material required to respond.

Initial efforts to bolster health preparedness in the aftermath of 9/11 and the Anthrax attacks were largely focused on bioterrorism. In hindsight, perhaps they were too focused. Biological threats are certainly important, but America faces other threats as well, as events in New Orleans, Joplin, New York, Boston, West, Moore and other cities have so tragically demonstrated. In the past few years, federal agencies have broadened their efforts and emphasized the need for flexibility. Evidence can be found in the Department of Homeland Security’s Quadrennial Homeland Security Review,¹⁸ the Department of Health and Human Services’ National Health Security Strategy,¹⁹ and a CDC monograph entitled, “In a Moment’s Notice: Surge Capacity for Terrorist Bombings.”²⁰

Grant monitoring remains a challenge. Until now, the federal government’s monitoring effort has focused more on structure (facilities, equipment and supplies) and process (i.e., the number and type of people hired, trainings held) than on desired *outcomes* – the capabilities local and state governments must have to successfully manage a disaster or terrorist attack. To cite an example from the world of public health preparedness, it’s one thing to ask that a grantee document that it has established and staffed a 24-hour, dedicated phone line that healthcare workers can call to report potential biological threats. It’s quite another to independently determine if the line gets answered, how long it takes someone to respond, and whether or not the guidance makes sense.²¹ As any baseball fan knows, a team can have great facilities, a talented roster, and still lose lots of games. Capacity is helpful, but it’s far more important to have a demonstrated *capability* to win when a game is on the line.

Some question whether or not FEMA’s grant programs are employing adequate measures to assess grantee activities and performance.²² Others object to FEMA’s proposed consolidation of

its preparedness grant programs.²³ Regardless of whether FEMA's current approach to grants is altered or retained, the agency faces a difficult task of identifying a manageable number of straightforward standards, focusing less on the process of grant management and more on achieving desired *capabilities* and *outcomes*.

RAND has not studied FEMA's grant programs, or assessed the approach it takes to monitoring grantee performance. Thus, I cannot directly address the impact of FEMA's grant programs. We have, however, worked closely with two agencies of the Department of Health and Human Services for more than a decade on issues related to public health preparedness. One of the key lessons we've learned is the need to develop and maintain a set of valid and reliable performance measures that can be used to track progress made, identify areas for improvement, and assist in the development of appropriate accountability systems. In some areas significant progress has been made in developing performance measures and implementing them consistently over time. For example:

- the Cities Readiness Initiative program developed the Technical Assistance Review tool to provide a basis for tracking progress over time and across states and metro areas, and
- CDC's PHEP Cooperative Agreement program developed a standard set of measures that have appeared in several recent national reports on preparedness.

But progress has been slowed by a number of factors that we've seen since the early days of our work. First, "preparedness" often looks different in different communities and scenarios. Where there has been good progress it has been through building measures around core "building blocks" that are common across communities and scenarios.

Second, measuring preparedness often requires a fair amount of effort on the part of the communities providing the data. Thus, where measurement has worked in the past it has often involved getting state/local stakeholders buy-in. Identifying good measures is the relatively easy part; setting up systems for collecting data over time is the tougher -- and more time consuming -- part.

As result, progress in developing good measures has been spotty, with few measures reaching a level of maturity required for supporting accountability decisions. The good news is that we have learned some important lessons about creating useful, sustainable measurement systems that could be applied more broadly.

1. Recommendations to strengthen preparedness research

At the end of our 2012 study of preparedness research,¹² we offered a few ideas to improve the process. They include recommendations to: a) employ a risk-based approach to priority setting; b) enhance coordination by forming an interagency working group; c) implement a simple process to categorize and track current and future preparedness research projects so officials can easily determine which agency is funding what and quickly disseminate key findings. Engaging practitioners in priority setting would help hasten the translation of research to the front lines, and shorten the feedback loop to the research community. Because disaster research is not amenable to randomized controlled trials, we need to be more open-minded about encouraging alternate approaches so we can learn from real-world events. Developing a standardized, searchable format for “after-action” reports would be a great place to start.²⁴ Instead of settling for “good enough,” we need to constantly strive for “better.” Steps like these, along with an ongoing commitment to preparedness research, will go a long way towards producing the evidence we need to strengthen public safety and protect the health security of the United States.

2. Recommendations to strengthen grant-making

Going forward, grant-making should be more focused on results. Our homeland security communities are bright, dedicated and effective. Why not specify the desired capabilities and outcomes, and let them determine the best way to get there?^{25,26} The analogy in medicine is monitoring every test or therapy a doctor orders rather than outcomes he or she achieves. After decades of spinning our wheels, we’re finally moving that way in healthcare. Let’s not wait several decades to do the same in emergency preparedness. Following the proper process, passing multiple audits and filling out every form correctly provides no comfort to those who lose their homes, go days or weeks without power, or find themselves separated from their loved ones in a disaster. DHS and FEMA have made an encouraging start on measuring outcomes with such programs as HSEEP (Homeland Security Exercise and Evaluation Program),²⁷ but the effort is still in its nascent stages.

Healthcare preparedness must be strengthened as well. The best way to do this is to build a strong foundation on efficient daily operations.⁴ There are strategies hospitals can implement today, such as smoothing elective surgery schedules and employing capacity management tools to optimize hospital operations, that will make a difference. Steps like these not only enhance efficiency and get admitted patients out of the ED, they strengthen a hospital’s capability to respond to a disaster. HHS’ Hospital Preparedness Program is tasked with enhancing capabilities but the \$347 million it is allocated cannot, by itself, reorient a \$2.8-trillion-per-year health care

industry to embrace preparedness: the economics don't work. But if America's hospitals can be persuaded to voluntarily weave preparedness into their daily routine, they'll become more efficient, more productive and be better prepared.

The only way a hospital can confirm its preparedness is to test it. Administrators can't assume that their staff will "rise to the occasion." Military officers teach that "You don't rise to the occasion; you fall to the level of your training." Observations gleaned from realistic drills, "stress tests," and small-scale events such as a multi-casualty trauma response can be used to assess various aspects of a facility's disaster plan. Gaps in performance should be addressed in a collaborative process, involving front-line staff and representatives of local public safety and emergency management agencies. Functional assessments of this sort should be expected of any FEMA or HHS grantee.

3. Recommendations to strengthen partnerships

Hospitals and healthcare organizations must be more willing to partner with FEMA. After all, a hospital can't respond to a disaster if it doesn't survive it in sufficient shape to function. As a condition for accreditation, The Joint Commission requires that hospitals conduct a hazard assessment and take steps to mitigate any threats. A useful tool worth considering is the Pan American Health Organization's Hospital Safety Index.²⁸ Additionally, we might consider making the periodic performance of rigorous threat assessments—and the reporting of findings and corrective action to FEMA and HHS as well as relevant local and state agencies—a condition for participation in the Medicare program. It should also be a condition for the continuation of any preparedness grant.

FEMA and the emergency management community must also be more open to work with public health and healthcare at every level from local to national. There are important health dimensions to nearly every domain on FEMA's core capabilities list.²⁹ Although it is likely that HHS' health preparedness capabilities and FEMA's core capabilities are better aligned than most people realize, comparable alignment of the agencies' grant-making and performance metrics would help everyone.

Finally, both FEMA and HHS should sit down with the staff of the National Center for Disaster Medicine and Public Health and non-governmental experts from several disciplines to establish core competencies for health professional training in disaster medicine and public health, then use these competencies to foster a national curriculum and create the core architecture for a national disaster health system. We did it for EMS without violating the concept of federalism; we

can do it here as well. This would ensure that everyone shares a common language, basic doctrine, essential skills and goals. For the sake of our citizens, these worlds should be brought together.

Reflecting on Boston's success, it's not enough to enumerate what went well; we must understand why. As Professor Peleg and I noted in our recently published essay¹ about the Boston Marathon Bombings, the Red Sox got some lucky breaks during the 2007 World Series, but their victory was largely due to preparation, teamwork, and execution. The same was true when Boston's citizens, first-responders, healthcare providers and hospitals delivered on April 15, 2013. They learned from the experiences of Madrid, London and Mumbai.⁴ We must learn from Boston.

References

- ¹ Kellermann AL, Peleg K. Lessons from Boston. *N Engl J Med* 2013; 368:1956-1957. DOI: 10.1056/NEJMp1305304.
- ² Golan R, Soffer D, Givon A. The ins and outs of terrorist bus explosions: injury profiles of on-board explosions versus explosions occurring adjacent to a bus. *Injury*. 2013 March 11 (Epub ahead of print).
- ³ Smith JF. Doctors share expertise on handling terror attacks. *The Boston Globe*. June 15, 2009 http://www.boston.com/news/world/worldly_boston/2009/06/doctors_share_expertise_on_han.html accessed July 4, 2013.
- ⁴ Hunt R, Askenazi I, Falk H. A Tale of Cities. *Disaster Med Public Health Prep*. 2011 Sep;5 Suppl 2:S185-8. doi: 10.1001/dmp.2011.62
- ⁵ Institute of Medicine Committee on the Future of Emergency Care in the U.S. Health System. *Hospital Based Emergency Care: At the Breaking Point*. Washington D.C. The National Academies Press. 2007.
- ⁶ Kellermann AL. Waiting Room Medicine: Has It Really Come to This? *Ann Emerg Med*. 2010;56(5):468-471.
- ⁷ American College of Healthcare Executives Announces Top Issues Confronting Hospitals: 2012. <http://www.ache.org/Pubs/Releases/2013/Top-Issues-Confronting-Hospitals-2012.cfm> accessed July 4, 2013.
- ⁸ Peleg K, Kellermann AL. Enhancing hospital surge capacity for mass casualty events. *JAMA*. 2009;302(5):565-567.
- ⁹ Pan American Health Organization. *Safe Hospitals General Information*. http://new.paho.org/disasters/index.php?option=com_content&task=blogcategory&id=1026&Itemid=911%20 accessed July 4, 2013.
- ¹⁰ Kellermann A. "Generation Ex" *The RAND Blog*. <http://www.rand.org/blog/2012/11/generation-ex.html> accessed July 4, 2013.

¹¹ Schoch D. Many Southern California hospitals rebuff government over disaster plans. Los Angeles Daily News. Posted: 01/12/2013 at http://www.dailynews.com/ci_22363223/many-socal-hospitals-rebuff-government-over-disaster-plans?IADID=Search-www.dailynews.com-www.dailynews.com accessed July 4, 2013.

¹² Shelton S, Connor K, Usher-Pines L, Pillemer FM, Kellermann AL. Bioterrorism And Biological Threats Dominate Federal Health Security Research; Other Priorities Get Scant Attention. Health Affairs. DOI: 10.1377/hlthaff.2012.0311 HEALTH AFFAIRS 31, NO. 12 (2012: 2755–2763

¹³ Shelton S. “Far More U.S. Health Security Research Effort Aimed at Bioterrorism than Natural Disasters” The RAND Blog.

¹⁴ Allocation of Scarce Resources During Mass Casualty Events. June 2012. Agency for Healthcare Research and Quality, Rockville, MD.
<http://www.ahrq.gov/research/findings/evidence-based-reports/er207-abstract.htm> accessed July 4, 2013.

¹⁵ Government Accountability Office. National Preparedness: Improvements Needed for Measuring Awardee Performance in Meeting Medical and Public Health Preparedness Goals. GAO-13-278, Mar 22, 2013.

¹⁶ Willis H, Nelson C, Shelton S et al. Are Communities Ready to Conduct Rapid and Large-Scale Dispensing of Medications During a Public Health Emergency? Santa Monica, RAND Corporation. 2009. http://www.rand.org/pubs/research_briefs/RB9434.html accessed July 5, 2013.

¹⁷ Nelson C, Parker A, Shelton S, et al. Analysis of the Cities Readiness Initiative. Santa Monica, CA. RAND Corporation. 2012. TR-1200-CDC.
http://www.rand.org/pubs/technical_reports/TR1200.html accessed July 5, 2013.

¹⁸ Quadrennial Homeland Security Review. Washington, DC, U.S. Department of Homeland Security. 2010. http://www.dhs.gov/xlibrary/assets/qhsr_report.pdf accessed July 4, 2013.

¹⁹ The National Health Security Strategy of the United States of America. Washington, DC. U.S. Department of Health and Human Services. 2009.
<http://www.phe.gov/Preparedness/planning/authority/nhss/strategy/Pages/default.aspx> accessed July 4, 2013

²⁰ National Center for Injury Prevention and Control. In a Moment's Notice. Surge Capacity for Terrorist Bombings. Atlanta (GA): Centers for Disease Control and Prevention; 2007 <http://www.bt.cdc.gov/masscasualties/surgecapacity.asp> accessed July 4, 2013.

²¹ Dausey DJ, Lurie N, Diamond A. Public Health Response to Urgent Case Reports. Health Affairs. 2005; August 30, 2005; 10.1377/hlthaff.w5.412

²² Coburn T. Safety at Any Price: Assessing the Impact of Homeland Security Spending in U.S. Cities. Washington, DC. December, 2012.

²³ NATIONAL PREPAREDNESS: FEMA Has Made Progress, but Additional Steps Are Needed to Improve Grant Management and Assess Capabilities Washington, DC. Government Accountability Office. GAO-13-637T, Jun 25, 2013. <http://www.gao.gov/products/GAO-13-637T>

²⁴ Nelson C, E Beckjord, D Dausey, et al. How Can We Strengthen the Evidence Base for Public Health Emergency Preparedness? Disaster Medicine and Public Health Preparedness. 2008;2(4): 1-4.

²⁵ Jackson B, McKay S. Preparedness Exercises 2.0: Alternative Approaches to Exercise Design That Could Make Them More Useful for Evaluating — and Strengthening — Preparedness. Santa Monica, CA. RAND Corp. http://www.rand.org/pubs/external_publications/EP201100128.html accessed July 7, 2013.

²⁶ Jackson BA, Faith KS, Willis H. Are We Prepared? Using Reliability Analysis to Evaluate Emergency Response Systems. Santa Monica, CA. RAND Corp. http://www.rand.org/pubs/external_publications/EP201100141.html accessed July 7, 2013.

²⁷ FEMS Homeland Security Evaluation and Exercise Program: HSEEP. https://hseep.dhs.gov/pages/1001_HSEEP10.aspx accessed July 8, 2013.

²⁸ Pan American Health Association. The Hospital Safety Index. http://www.paho.org/disasters/index.php?option=com_content&task=view&id=964&Itemid=911 accessed July 4, 2013.

²⁹ Core Capabilities List. <http://www.fema.gov/core-capabilities> accessed July 5, 2013.