



Bioterrorism and Health System Preparedness



Surge Capacity: Facilities and Equipment

Introduction

Surge capacity is a health care system's ability to expand quickly beyond normal services to meet an increased demand for medical care in the event of bioterrorism or other large-scale public health emergencies.

A large-scale public health emergency would be likely to result in great numbers of human casualties. The ill and injured would be expected to seek care wherever they thought possible: in hospitals, public health clinics, doctors' offices, and non-traditional settings. Planning for response to a bioterrorism event or other public health emergency must take into account the capacity of local and regional facilities to accommodate the surge in patient loads. Alternative care sites may be needed. In response to a hazardous materials, chemical, or nuclear event, decontamination would be required before

patients are allowed to enter a treatment facility. A biological event might require isolation of patients. All of these events would require personal protective equipment for emergency responders and health care personnel. Pharmaceutical supplies must be available to treat patients. Finally, procedures must be in place to coordinate patient flow and treatment.

In 2004, the Agency for Healthcare Research and Quality (AHRQ) expanded its Bioterrorism Preparedness Research portfolio to include several projects that focus on surge capacity issues. On July 13, 2004, AHRQ sponsored a Web conference devoted to the need for facilities and equipment as a critical component in planning for surge capacity. This issue brief summarizes that Web conference.

Four panelists made presentations:

- ▲ Lieutenant Commander Sumner Bossler, Jr., R.N., C.E.N., Health Resources and Services Administration, U.S. Department of

The Agency for Healthcare Research and Quality (AHRQ) is the lead agency charged with supporting research designed to improve the quality of health care, reduce its cost, address patient safety and medical errors, and broaden access to essential services. AHRQ sponsors and conducts research that provides evidence-based information on health care outcomes; quality; and cost, use, and access.

The information helps health care decisionmakers—patients and clinicians, health system leaders, and policymakers—make more informed decisions and improve the quality of health care services.



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Health and Human Services,
Washington, DC

- ▲ Bettina Stopford, R.N., Science Applications International Corporation, McLean, Virginia
- ▲ David Markenson, M.D., Director, The Program for Pediatric Preparedness, Mailman School of Public Health, Columbia University, New York
- ▲ David Gruber, Assistant Commissioner, New Jersey Department of Health and Senior Services, Trenton, New Jersey

Lieutenant Commander Bossler outlined the guidance on facilities and equipment that has been promulgated by the National Bioterrorism Hospital Preparedness Program. Ms. Stopford presented findings from a project funded by AHRQ to develop models for the use of personal protective equipment, isolation/quarantine, laboratory capacity, and decontamination. Dr. Markenson discussed recommendations that grew out of an AHRQ-sponsored conference on pediatric preparedness for disasters and terrorism. David Gruber described how the State of New Jersey has approached planning for surge capacity. A question and answer period followed presentations by the panelists.

The Role of the National Bioterrorism Hospital Preparedness Program

The National Bioterrorism Hospital Preparedness Program was initiated in 2002 to reinforce the infrastructure and health care system of the country.

Administered by the Health Resources and Services Administration (HRSA), the program's 62 grantees include the 50 States, Washington, DC, New York City, Chicago, and Los Angeles, plus Puerto Rico, the Virgin Islands, and the Pacific Territories. Regional Surge Capacity is the second of six priority areas for 2004.

The Program Guidance for 2004 includes 16 Critical Benchmarks, which are intended to measure preparedness. Under Regional Surge Capacity, Critical Benchmarks have been established for:

- ▲ Hospital bed capacity
- ▲ Isolation capacity
- ▲ Health care personnel
- ▲ Advance registration system
- ▲ Pharmaceutical caches
- ▲ Personal protective equipment
- ▲ Decontamination
- ▲ Behavioral health
- ▲ Trauma and burn care
- ▲ Communications and information technology

Of these, hospital bed capacity, isolation capacity, health care personnel, personal protective equipment, decontamination, and communications and information technology are related to facilities and equipment. Critical Benchmarks for these categories are presented in Exhibit 1. Lieutenant Commander Bossler pointed out that surge capacity starts with the additional number of patients (hospital bed capacity) that might be expected in an event, and that health care personnel and facilities and equipment must be proportional to that additional number of patients.

Additional information on hospital preparedness for bioterrorism is available at the HRSA Web site: www.hrsa.gov/bioterrorism/index.htm.

Development of Models for Emergency Preparedness

Under a grant from AHRQ, Science Applications International Corporation (SAIC) has developed models for the use of personal protective equipment, isolation/quarantine, laboratory capacity, and decontamination. For each subject, the goal for model development was to create a user tool for operational planning that was founded on evidence-based, best demonstrated practices.

The SAIC team conducted literature searches, reviewed government and industry regulations, conducted interviews with subject matter experts, asked stakeholders to review the draft document and models, and held a stakeholder conference. Development of each model took into consideration such factors as:

- ▲ Adaptability for use in different regions of the country and in different settings (e.g., urban versus rural)
- ▲ Cost, including supplies, logistics, and training
- ▲ Level of training required, initially and over time
- ▲ Resources required, including whether the model could be built on existing practices and infrastructure
- ▲ Impact on morbidity and mortality
- ▲ Regulatory compliance



Exhibit 1

Regional Surge Capacity: Critical Benchmarks Related to Facilities and Equipment

Critical Benchmark 1: Hospital Bed Capacity

Establish a system that allows the triage, treatment, and initial stabilization of 500 adult and pediatric patients per 1,000,000 awardee jurisdictions (1:2000) above the current daily staffed bed capacity, who have acute illnesses or trauma requiring hospitalization from a chemical, biological, radiological, nuclear, or explosive incident.

Critical Benchmark 2: Isolation Capacity

Upgrade or maintain airborne infectious disease isolation capacity to have at least one negative pressure, high efficiency particle arrester (HEPA)-filtered isolation facility per awardee. Such facilities must be able to support the initial evaluation and treatment of 10 adult and pediatric patients at a time who have a clinical contagious syndrome suggestive of smallpox, plague, or hemorrhagic fever, prior to movement to a definitive isolation facility.

Critical Benchmark 3: Health Care Personnel

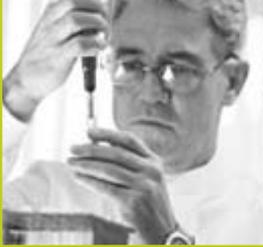
Establish a response system that allows the immediate deployment of additional health care personnel in support of surge bed capacity noted in Critical Benchmark #2.1. The number of health care personnel must be linked to already established patient care ratios noted by the awardee's Patient Care Practice Acts based on 24-hour operations. This benchmark must describe how these personnel are recruited, received, processed, and managed through the incident.

Critical Benchmark 6: Personal Protective Equipment

Each awardee must ensure adequate personal protective equipment (PPE) per awardee-defined region to protect current and additional health care personnel during a chemical, biological, radiological, or nuclear incident.

Critical Benchmark 7: Decontamination

Ensure that adequate portable or fixed decontamination systems exist for managing adult and pediatric patients as well as health care personnel who have been exposed during a chemical, biological, radiological, nuclear, or explosive incident in accordance with the numbers associated with Critical Benchmarks #2.1 and #2.3. All decontamination assets must be based on the number of patients/providers that can be decontaminated hourly. The awardee should plan to be able to decontaminate all patients and providers within 3 hours from the onset of the event.



Major findings were as follows:

Personal Protective Equipment (PPE).

The choice of personal protective equipment depends on whether the professional personnel involved are dealing with an infectious patient event or a contaminated patient event. For an infectious patient event, PPE is determined by infection control guidelines promulgated by the Centers for Disease Control and Prevention (CDC) and the Association for Professionals in Infection Control and Epidemiology. For a contaminated patient event, which typically involves radiation or chemical contamination, standards are currently based on industry guidelines, such as Occupational Safety and Health Administration compliance. The report recommends that for a contaminated patient event the minimum standard should be special Level C PPE; i.e., a hooded, battery-powered air purifying respirator with filters appropriate to the event, and appropriate protective clothing.

Ultimately, a community should base its selection of PPE on the results of a local hazards vulnerability analysis, which should reveal credible threats, and on the role of the user of the PPE (e.g., emergency medical services [EMS] or hospital-based).

Isolation/Quarantine. Isolation issues are different from quarantine issues. Isolation within a health care facility typically involves a set of rooms or certain areas where infected patients can be segregated from other patients. A surge event, however, would probably overtax current health care facilities' isolation capacity. Preparation for surge capacity might include retrofitting an

existing facility or developing portable isolation units.

Quarantine, on the other hand, involves not just facilities but legal authority and interaction with law enforcement officials. One of the findings of the SAIC report entitled, *Development of Models for Emergency Preparedness*, is that to increase community-based compliance and resilience, a public education program is needed before the initiation of a quarantine.

Laboratory capacity. CDC has established a hierarchy of laboratory capacity levels to respond to a possible bioterrorism event. The challenge now is to make that system work as efficiently as possible, which includes making sure health care professionals understand the procedures involved. There is an inherent stress between, on the one hand, the responder's need to identify the agent as soon as possible to be able to start treatment, and on the other hand the time required in the laboratory to identify the agent accurately. Timeliness, accuracy, and security of laboratory diagnostics will have a direct impact on containment, mitigation, and clinical treatment.

Decontamination. Decontamination in a mass casualty event, said Ms. Stopford, involves more than "having potentially contaminated patients...naked in the parking lot with a fire hose on them." Hasty decontamination may actually increase physiologic complications. With basic planning and practice, technical mass casualty decontamination can be a cost-effective, rapidly mobilized, life saving asset. An effective decontamination facility requires gender-segregated areas that are sheltered from the environment, where,

at a minimum, patients can remove their clothing, wash off the contaminating agent, and don clean clothing before entering the treatment facility.

Development of mass casualty decontamination capabilities is a community issue, and should involve both health care facilities and pre-hospital agencies. The report recommends a spiral development approach based on credible threat data, starting with public education and simple sheltered areas for clothing removal. Protection of critical infrastructure, including responder and hospital-based personnel and assets, is key to sustaining a community's ability to continue to provide life saving care in an event that requires mass casualty decontamination.

The SAIC project has quantified best practices for decontamination in an interactive database; the user can enter local data to determine current capabilities, throughput, and training and staffing needs.

Pediatric Disaster and Terrorism Preparedness

Dr. David Markenson and colleagues have developed a set of recommendations that stem from an ARHQ-supported consensus conference on pediatric preparedness for disasters and terrorism. Dr. Markenson explained that the special needs of children in public health emergencies must be looked at in multiple ways. The first is on the basis of their unique anatomy and physiology, which puts them at different risk from adults. For example, because children breathe faster than adults, anything that is transmitted through inhalation,



whether it is biologic, chemical, or radiologic, will be absorbed more quickly by children. In addition, the unique anatomy and physiology of children requires different therapies and different types of treatments and medications and equipment.

Also important is that two types of pediatric exposure must be considered. One is inadvertent, in which children should be considered as part of the general population that would be affected by terrorism, disasters, and other public health emergencies. Children and youth comprise approximately 25 percent of the population of the United States, and more than 20 million children are under the age of six. Thus, children should be included in a jurisdiction's preparedness plan. "One cannot have a surge plan that does not include pediatric patients," said Dr. Markenson.

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The second type of exposure to be considered is the intentional targeting of children by a terrorist attack. (Dr. Markenson's warning at the July audio conference, of course, preceded the terrorist attack on the school in the town of Beslan in southern Russia on September 1, 2004.) An attack on a school or daycare center, for example, would constitute a uniquely pediatric event, in which the number of children involved would be out of proportion to

the normal percentage seen by a health care facility and out of proportion to traditional surge planning.

Planning for pediatric surge capacity should take the above factors into account; i.e., the plan must include pediatric patients as part of the affected population, and should also prepare for the unique circumstances of an "all-child event." A third critical factor in planning for pediatric surge capacity is the capability to treat children with their parents as a family unit. Because it is unrealistic to assume that parents would be willingly separated from their children during an emergency, providers must be prepared to treat them together.

The key to personnel planning for pediatric surge capacity is training providers. Those who customarily treat adults must also be prepared to treat children. Pediatric providers should anticipate supervising adult providers caring for children, but they must also be prepared to treat adults as well as children.

Federal and State resources are available for public health emergencies, but they have limitations where children are concerned. At the Federal level, the Strategic National Stockpile (SNS) would be deployed, but its equipment and pharmaceuticals are limited to U.S. Food and Drug Administration indications; if something is not indicated for children, the SNS cannot stock it. Similarly, the Disaster Medical Assistance Teams that would be deployed as part of the National Disaster Medical System do not have a requirement for pediatric-trained

providers, and they do not have a requirement for pediatric equipment.

At the State level, stockpiles are often based on the list of the National Stockpile, so the same problems exist. The States' Medical Reserve Corps, which are composed of local physician volunteers and other health care providers, have no requirement for pediatric training or pediatric providers. Hospitals must therefore assume that none of these Federal and State resources has pediatric capability, and that their pediatric surge planning should be premised on the likelihood that they will have to survive on their own.

A major local consideration for pediatric surge planning is decontamination. Decontamination is a prime example of ways in which children's unique anatomy, physiology, and mental health needs come into play. Issues important to consider in the decontamination of children include water pressure, water temperature, size of hospital gowns, non-ambulatory children, moving infants and toddlers through the process, and the psychological effects of the process on the children.

To identify and address the gaps in pediatric preparedness, in 2002 Congress established the National Advisory Committee on Children and Terrorism. That committee submitted a report to the Secretary of Health and Human Services that included recommendations on a comprehensive public health strategy to ensure the safety of children in the face of the threat of terrorism. The recommendations were directed to the



Federal Government but are also applicable to State and local governments, and would serve as an excellent template for how States and local governments can assure the needs of children are met. The report is available on the CDC Web site at www.bt.cdc.gov/children.

In addition, the specific elements of pediatric preparedness were developed by an AHRQ-funded conference in February 2003. The Report of Pediatric Preparedness for Disasters and Terrorism: National Consensus Conference provides the first and only set of pediatric emergency preparedness guidelines and treatment recommendations. The report also includes guidance for pre-hospital and hospital care, recommendations on training, and specific guidance regarding numbers of equipment, numbers of providers, actual dosages, and treatment protocols needed across the range of possible disasters, terrorism, and other public health emergencies. The full report can be found on the CDC Web site (www.bt.cdc.gov/children) and on the National Center for Disaster Preparedness Web site at www.ncdp.mailman.columbia.edu.

The experts who participated in the consensus conference have formed the Pediatric Expert Advisory Panel. This is a multi-disciplinary group, composed of governmental and non-governmental experts, that is able to respond to new threats or evaluate new technology and then disseminate the findings on the National Center for Disaster Preparedness Web site. Findings are also disseminated through conferences and symposia.

The New Jersey Health Emergency Preparedness and Response Program

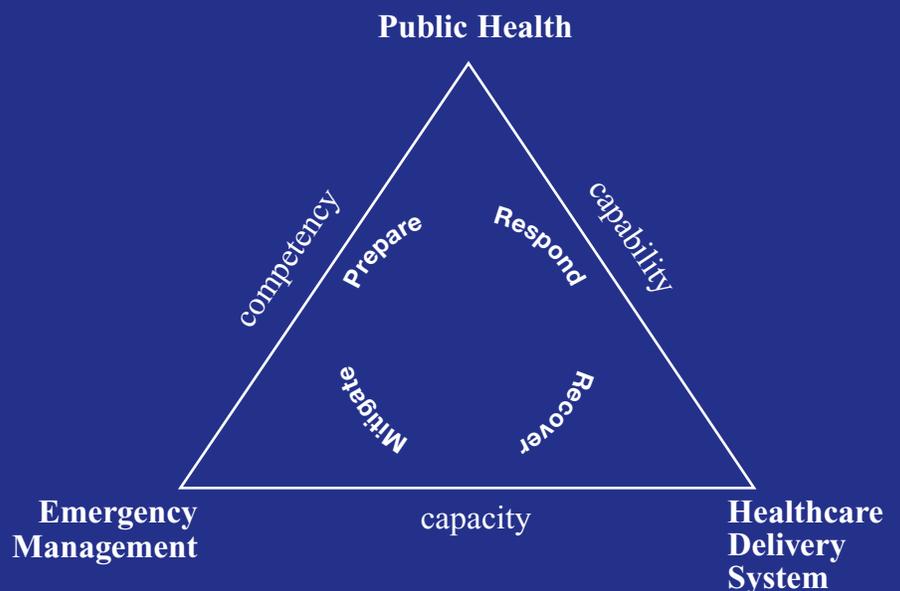
David Gruber described how New Jersey has approached surge capacity, which it defines as “the ability to exceed standard response in reaction to an event that would overwhelm the normal capacity of healthcare facilities.” The State initially took a “band-aid” approach to some of the critical issues that needed to be addressed immediately, then stepped back and developed a strategic plan that is centered not on individual hospitals but on the health system as a whole.

The strategic plan addresses two threat scenarios: An acute event, such as an explosion or a chemical attack, would

have an immediate impact that would likely traumatize the health system. A chronic event would be slow moving and would have long-term effects and long-term care requirements. The plan was built on the concept of a “Health Emergency Preparedness and Response Triad.” This approach ensures that public health, health care delivery systems, and the emergency management system would all be linked and would coordinate efforts to address the problem.

New Jersey’s approach to HRSA’s surge capacity benchmarks was to use them to evaluate their programs, specifically to measure their Emergency Preparedness and Response Health System Network. They also created a new division within the Department of Health to address the issues that frame

The Health Emergency Preparedness and Response Triad





the benchmarks, including plans and policy, infrastructure, and education and training.

New Jersey has supplemented CDC and HRSA funding with State bioterrorism funds, which New Jersey designates as MEDPREP funds. Funds have been applied to programs in accordance with a 3-year road map in which the first year focused on developing an infrastructure; the second year focused on command, control, and communications; and the third year focused on exercising the system.

Three programs are currently being put in place to address surge capacity in New Jersey. One is a network of Medical Coordination Centers, which are based on the State's five public health regions. The second is a Strategic State Stockpile, which is intended to bridge the gap between an event and when supplies from the national stockpile might arrive, and to cover specialized care, such as pediatric care. The third is information technology initiatives. Several software packages will be integrated into the Medical Coordination Centers to provide information regarding the health care system, both on a daily basis and also during an event.

To learn more about New Jersey's approach to surge capacity planning, listeners were invited to contact Mr. Gruber at david.gruber@doh.State.nj.us.

Discussion

In the question and answer period that followed the presentations, three subjects received extended attention:

▲ Pediatric preparedness for surge

capacity, including pharmaceuticals in the SNS and the possibilities for including children in drills.

▲ Other special populations, including geriatric, visually impaired, medically underserved, and non-English speaking populations.

▲ Decontamination, based on an all-hazards approach and on the current threat within a region.

Pediatric Preparedness for Surge Capacity

In response to a question about the contents of the SNS that are appropriate to the care of children, David Markenson noted that, for security reasons, a list of contents and quantities in the SNS is not commonly available. He suggested an alternative approach, which was to ask the local public health department and local Office of Emergency Management about what specific items would have to be provided locally. This would be mostly antibiotics, but also equipment.

In response to a question about conducting a drill of pediatric surge capacity, Dr. Markenson suggested it might be easier than one might first assume, because children naturally like to dress up, try on costumes, and play make-believe. With enough appropriate chaperones, a facility that wants to conduct a pediatric drill can usually find children through Boys and Girls Clubs or through Girl Scouts and Boy Scouts.

He also cited the experience of having worked in some communities with a school health or science teacher to make the drill a school project. The children wrote out what they were going to do, then with the parents' permission, and with parent leaders just

the way they would have on any other school trip, they went through the drill. The children had an enjoyable time, and the health professionals and others conducting the drill gained the experience not only of working with numbers of children but also with the way children act. Said Dr. Markenson, "They have to learn how to explain things to children. They have to learn how to make them pay attention. They have to learn to make them follow through and they have to make sure they feel comfortable and safe."

Other Special Populations

Children, of course, are not the only special population that should be included in planning for surge capacity. One caller pointed out that the largest increasing part of the population is the geriatric sector. Chronic diseases and decreased ability to cope both physically and emotionally among the elderly are thus definite considerations. Dr. Markenson suggested that the approach taken with the needs of children could be used as a model for other populations that need special attention. The first step is to define the unique anatomy, physiology, and medical conditions in response to the environment and possible trauma. Then consider the different threats that may apply and develop solutions based on those threats.

Some work is being done with special populations. Dr. Markenson explained that such work is very preliminary in the disabled population and has not been done to a great extent in the geriatric population. Other populations, such as the visually impaired, the medically underserved, and non-English speaking populations appear not to have been addressed yet.



Decontamination

Bettina Stopford urged all hospitals to develop technical mass casualty decontamination capabilities and a trained decontamination team. She said that the capacity to decontaminate patients should be based on the community-based hazard vulnerability assessment. That assessment should determine the most likely cause of exposure and how many people are likely to be exposed.

David Gruber added that the concept of regional planning may be applied to decontamination, but emphasized the importance of decontamination capacity at each hospital. He pointed out that actual terrorism events involving a chemical agent in other countries, and industrial accidents in this country, have shown us that patients will arrive predominantly by themselves and will go to the nearest health care facility they know of. He also cautioned that in a surge event hospitals should not assume that first responders, such as the fire department

or EMS, will be available to augment the hospital's own decontamination capabilities. Rather, one must assume that in a large-scale event the first responders are going to be deployed to the scene of the event and that the hospital must have its own capability. Yet another consideration is that, as the Sarin attack in Tokyo showed, one can never assume patients will arrive decontaminated. In Tokyo, patients walked to the hospital on their own, without being decontaminated, and incapacitated several emergency room physicians.

For More Information

The audioconference on which this issue brief is based, *Surge Capacity: Facilities and Equipment*, is also available as a streaming presentation and as a text transcript on the Bioterrorism Preparedness section of AHRQ's Web site (www.ahrq.gov/browse/bioterbr.htm).

Several resources on health system preparedness for bioterrorism have

been developed under funding from AHRQ and are available on the AHRQ Web site (www.ahrq.gov). Particularly relevant to facilities and equipment, in addition to the SAIC report discussed above, is the Rocky Mountain Regional Care Model for Bioterrorist Events, which discusses bed capacity, personnel resources, and alternative care facilities in response to a surge event. (On the Bioterrorism Preparedness section of the AHRQ Web site, select "Locate Alternate Care Sites During an Emergency.") *Decontamination of Children, Preparedness and Response for Hospital Emergency Departments*, a video training tool for hospital, emergency medicine, and pediatric personnel on caring for children contaminated by chemical agents is also available.

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