



Bioterrorism and Other Public Health Emergencies

Tools for Planning and Preparedness

Emergency Preparedness Atlas U.S. Nursing Home and Hospital Facilities

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Emergency Preparedness Atlas

U.S. Nursing Home and Hospital Facilities

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U.S. Department of Health and Human Services
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Rockville, MD 20850
www.ahrq.gov

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Prepared by:

Elisabeth D. Root, M.A.
Justine L. Allpress
James C. Cajka, M.A.
Shari B. Lambert
Lucy A. Savitz, M.B.A., Ph.D.
Shulamit L. Bernard, R.N., Ph.D.

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Introduction

The Agency for Healthcare Research and Quality (AHRQ) sponsored the preparation of the *Emergency Preparedness Atlas: U.S. Nursing Home and Hospital Facilities* to support local/regional planning and response efforts in the event of a bioterrorism or other public health emergency. This tool is intended to stimulate productive discussion about how nursing homes may be used to handle a surge of patients in response to emergency situations—it is not a review of the quality or adequacy of preparedness efforts in any area. The *Atlas* is divided into four main sections. Section 1 provides an abstract of the overall AHRQ-funded project, entitled *Exploring the Special Needs and Potential Role of Nursing Homes in Surge Capacity for Bioterrorism and Other Public Health Emergencies*, of which this *Atlas* is a part. Section 2 provides an overview of the *Atlas*. Section 3 is a series of case studies illustrating the ways in which nursing homes may be used to accommodate a surge of patients in six States. Section 4 includes maps of selected health care facilities for all 50 States and the District of Columbia. Finally, two appendixes provide technical notes and detailed tabular data supporting the 51 maps.



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Exploring the Special Needs and Potential Role of Nursing Homes in Surge Capacity for Bioterrorism and Other Public Health Emergencies

Project Abstract



PROJECT OVERVIEW

Most health care preparedness planning efforts have focused on hospital and first responder preparedness. Both the needs and potential role of nursing homes, which house the particularly vulnerable elderly population, have emerged in local and national preparedness discussions, but very little information exists on the extent to which nursing homes have planned for and/or have been incorporated into regional planning efforts. The Agency for Healthcare Research and Quality (AHRQ) has called for research to identify ways to augment hospital bed capacity during public health emergencies. To better understand the role that nursing homes could play with respect to regional preparedness, RTI International (hereinafter referred to as RTI) examined the current status of nursing home disaster planning and response, elasticity of staff and licensed beds, space availability, and special needs. (RTI International is a trade name of Research Triangle Institute.)

Exploring the Special Needs and Potential Role of Nursing Homes in Surge Capacity for Bioterrorism and Other Public Health Emergencies is a task funded under a master task order to RTI's Integrated Delivery System Research Network (IDSRN) (Contract #290-00-0018, Task 10) by the Agency for Healthcare Research and Quality (AHRQ). RTI is a nonprofit research organization based in Research Triangle Park, North Carolina. The RTI IDSRN is a network of five health systems committed to high-quality, applied research. Four of these systems with hospital facilities in seven States were included in this project:

- Intermountain Health Care (Utah)
- Providence Health System (Oregon, Washington, Southern California, and Alaska—Alaska was excluded for the purposes of this project)
- University of North Carolina (UNC) Health Care
- University of Pittsburgh Medical Center (UPMC) Health System

APPROACH

RTI conducted a cross-sectional study using mixed methods to address specific research questions. We drew on a series of secondary datasets to assess the location and capacity of nursing homes in the entire United States. Using these data, we more closely examined the policy, regulation, surge capacity, and response planning issues of nursing homes in the six States above. RTI conducted interviews with IDSRN partner representatives in these States. We then convened in-person focus groups with staff from nursing homes that have patient flows to our partner health systems in five of these States to ascertain special needs, planning, and capacity issues. We used the results of the interviews and focus groups and developed this report.

Emergency Preparedness Atlas: U.S. Nursing Home and Hospital Facilities combines findings from the interviews with information obtained through a larger environmental assessment to help explain the State-specific regulatory environment of nursing homes with respect to surge capacity and nursing home geographic distribution in the United States.

In conducting this environmental assessment, we used geographic information system (GIS) technology to synthesize and analyze the distribution of nursing home and hospital facilities across the United States. The *Atlas* presents these results as a series of six case studies for the States where our IDSRN partners are located. These case studies assess issues of regional planning concordance relevant to preparedness and response in disaster situations. In addition to the six case studies, we created maps for each of the 50 States and the District of Columbia examining the location of hospitals and nursing homes relative to the distribution of the elderly population.

KEY STAFF/PARTNERS

Elisabeth D. Root, M.A. – Project Director

David Dosa, M.D., M.P.H. – Co-Investigator (Brown University Medicine Foundation)

Shulamit L. Bernard, R.N., Ph.D. – Senior Scientist

Sally Phillips, Ph.D. – AHRQ Project Officer

IDSRN Partners: Intermountain Health Care, Providence Health System, UNC Health Care, UPMC Health System



Atlas Overview

Emergency Preparedness Atlas: U.S. Nursing Home and Hospital Facilities

As evidenced by observed acts of terror here and abroad and infectious disease outbreaks such as the severe acute respiratory system (SARS), detecting such threats, communicating these in real time to the clinical, public health, and lay communities, and effectively triaging and treating afflicted populations are extraordinarily difficult and complex. Federal agencies have endeavored to provide the health care community with relevant information on threats of bioterrorism and other public health emergencies and to work with communities in relief efforts following natural and man-made disasters. One difficulty in planning for such an event is the need for integration and coordination of the agencies and health care across the care continuum. A complex assemblage of local, State, and Federal government agencies must work together efficiently with community-based providers of care. All this must be accomplished within a burdened and fragmented health care delivery system.

To be fiscally viable in today's market, most hospitals today run at or above 80 percent

occupancy at baseline. This industry constraint, together with the facts that a population perspective is essential and multiple stakeholders must be involved for effective response, has led to the creation of the Metropolitan Medical Response System (MMRS) program approach documented in an Institute of Medicine report (IOM, 2002). Our experience and the IOM report underscore issues around interorganizational collaboration necessary for coordinated response (e.g., hospital systems, nursing homes), which we address in our study. (See the Project Abstract section for greater detail on the full project.)

The majority of health care preparedness planning efforts have focused on hospital and first responder preparedness. Nevertheless, for bioterrorism and other public health emergencies, the elderly population is particularly vulnerable. Both the needs and potential role of nursing homes, which house the elderly population, have emerged in local and national preparedness discussions, especially in the wake of Hurricane Katrina. As a Nation, we have little understanding

of the extent to which nursing homes have planned for disasters and/or been incorporated into regional planning efforts (Dosa et al., 2003; Helget and Smith, 2002). In preliminary research in the greater Pittsburgh, PA, area, RTI staff found that nursing home facilities and their medical staffs were unprepared to recognize and respond to a terrorist event. They hypothesized that nursing homes may strategically contribute to preparedness in rural communities, especially in those communities where no hospital facility is located.

The genesis for this project was a series of AHRQ-sponsored regional bioterrorism meetings in 2003. RTI staff observed wide variability in coordination between preexisting and newly funded bioterrorism preparedness regions. It was speculated that such variation could create areas of overlap or gaps between service regions, which might lead to problems coordinating response or recovery efforts.

The maps in the *Atlas* display the location of hospitals and nursing homes relative to the regional boundaries used by a variety of emergency management and bioterrorism preparedness organizations to coordinate services. The *Atlas* is designed to be a tool to support local and regional planning efforts.

One of the unique features of an atlas is its ability to bring together many data elements from a variety of different sources and display them in relation to one another in a certain place for a certain time. An atlas allows us to develop research questions related to space and encourages us to explore the data in ways we might not have considered when using more traditional methods of data analysis (e.g., tables, charts, and graphs). However, this type of analysis relies heavily on the use of accurate and timely data in order to provide a representative picture at a single point in time (i.e., static, cross-sectional approach).

TECHNICAL APPROACH

Content

The first step in developing the *Atlas* was to conceptualize key research questions uniquely suited to this type of geographic analysis. Maps are excellent tools for looking at the location of health services as well as the relative location of two or more different types of services. They can be used to explore areas of overlap or gaps between service regions that might lead to problems coordinating response or recovery efforts. This information can be used to examine the availability of resources in the context of coordination and preparedness efforts that are currently under way. Given this understanding, RTI developed the following research questions for the *Atlas*:

1. Are there nursing home facilities pivotally located in rural areas not served by hospital facilities that might offer strategic surge capacity?
2. How are health care delivery assets (i.e., hospitals, nursing homes) distributed across the rural-urban continuum?
3. How are emergency preparedness activities regionalized?
4. What is the concordance between different planning/response/recovery areas relevant to emergency preparedness?

Nursing Home Capacity Across the Rural-Urban Continuum

To answer research questions related to the location of nursing homes and hospitals across the urban-rural continuum (questions 1 and 2), RTI obtained information on the location of both nursing homes and hospitals, including the facilities' addresses, in order to locate each facility on a map. This information was used to examine where nursing homes were located in relation to area hospitals. Hospital and nursing home bed counts were deemed important in order to understand the capacity of each facility. RTI obtained population data to understand whether facilities were located in rural areas and how this might influence emergency planning at the regional and State level. More information on the sources used to derive these data is included in **Appendix A**. RTI originally proposed using only the IDSRN partners' States in the *Atlas*. However, early on in the project RTI staff decided that questions related to capacity could just as easily be depicted at a high level for non-IDSRN States due to the availability of national datasets (i.e., data available from one source that includes information for facilities/areas across the entire United States); thus, in-depth drill down is provided in the six States where IDSRN partners have facilities, and State-level maps are included for all 50 States and the District of Columbia.

Emergency Preparedness Regionalization

To address research questions related to regionalization of emergency preparedness activities (questions 3 and 4), the research team had to decide which planning/response/recovery organizations were most relevant to preparedness activities in a State. Each of these organizations operates within geographically defined regions. The relevance of different areas is dependent on the activity (e.g., response, communication, resource allocation, command and control) as well as how the event is defined (e.g., an epidemic/public health crisis vs. disaster recovery and relief).

Table 1 presents a list of organizations considered for this report and the functions that they serve.

Because the overarching goal of the project was to examine issues related to surge capacity, the RTI team decided that the regional configurations used by six different organizations were particularly relevant to this topic: Health Resources and Services Administration (HRSA) Bioterrorism Hospital Planning regions, Metropolitan Medical Response System (MMRS) regions, Emergency Medical Services (EMS) regions, Emergency Management (EM) regions, Hazardous Materials (HAZMAT) regions, and Trauma Advisory Coordination Committee

Table 1: Organizations Considered for Inclusion

Organization	Function
American Red Cross Chapters	Response and Mitigation
Area Health Education Centers	Education
Council of Governments	Communication, Coordination
Emergency Management	Response
Emergency Medical Services	Response
Federal Bureau of Investigation/Joint Terrorist Task Force	Command and Control, Communication
Federal Emergency Management Agency	Command and Control, Communication, Response
Hazardous Materials	Response
Health Resources and Services Administration's Bioterrorism Hospital Planning	Resource Allocation
Metropolitan Medical Response System	Resource Allocation, Coordination
Trauma Advisory Coordination Committees	Communication, Coordination

regions. Discussions with focus group members yielded one additional relevant configuration: American Red Cross regions. During focus groups with nursing home administrators, the role of the Red Cross with respect to relief and support activities in the aftermath of a disaster was noted, leading researchers to include Red Cross regions as well.

The boundaries for each region were developed using information collected through telephone conversations with State emergency planners. Often, comparing the boundaries of two or more regions reveals areas where coordination between different agencies may be difficult. A brief description of each of the regions used in the *Atlas* is included below.

1. HRSA Bioterrorism Hospital Planning

Regions—Regions developed by each State for use in distributing HRSA grant funds. The HRSA grants are intended to upgrade the preparedness of the Nation’s hospitals and collaborating entities in responding to bioterrorism and other public health emergencies. This includes the development and implementation of regional bioterrorism preparedness plans and protocols to improve the capacity of hospitals, their emergency departments, EMS systems, outpatient centers, and other collaborating health care entities for response to a bioterrorist incident. Most HRSA bioterrorism regions are county based, though some adjustments are made for patient flow.

2. Metropolitan Medical Response System (MMRS)—Regions developed by each State in response to a U.S. Department of Homeland Security (DHS) funded program designed to develop or enhance existing emergency preparedness systems to effectively respond to a public health crisis. Through preparation and coordination, local law enforcement, fire, HAZMAT, EMS, hospital, public health, and other “first response” personnel plan to more effectively respond in the first 48 hours of a public health crisis. Each State developed MMRS regions based on different criteria. Some States chose to designate county-based regions that mirror metropolitan statistical areas (MSAs), while others used counties but expanded beyond current MSA boundaries. Still other States designated are city-based MMRSs. These boundaries are dynamic (i.e., counties are added or dropped on an ongoing basis).

3. Emergency Medical Services (EMS) Coordination—Regions developed to mobilize and direct local EMS activities, including coordination of first responder, triage, and trauma center activities in cases of mass casualty or large area emergencies. Most States follow county boundaries in creating these regions.

4. Emergency Management (EM) Coordination—Regions developed to mobilize and

direct local public safety authorities having a role in emergency response and disaster relief, including police and fire departments. Most States follow county boundaries in creating these regions.

5. Hazardous Materials (HAZMAT) Coordination—Regions designed to organize specialized HAZMAT teams available to supplement the efforts of local government HAZMAT teams in incidents requiring a higher level of training and more sophisticated equipment. Many States do not have a regionalization of HAZMAT response; local fire departments are responsible for responding when situations arise. States with regional HAZMAT teams often use county boundaries, though some consider fire department boundaries.

6. Trauma Coordination—Regions designed to coordinate trauma care among hospitals. States often develop oversight committees for each region, though the name for these committees differs across States. Trauma coordinators develop and implement a coordination plan for the region’s trauma system, which may include pre-hospital triage and air medical protocols and transfer agreements and regional plans for education, training, prevention outreach, and quality assessment. Most trauma systems are based on county boundaries, though small adjustments are sometimes made for patient flows.

7. Red Cross Chapters—Traditionally, the Red Cross has been organized around county-based chapters to provide shelter, food, and health and mental health services in the event of a disaster. The Red Cross also feeds emergency workers, handles inquiries from concerned family members outside the disaster area, provides blood and blood products to disaster victims, and helps those affected by disaster to access other available resources. Recent consolidation has yielded multi-county chapters in many States, and some counties are jointly served by two or more adjacent chapters.

These regions have evolved based on local/regional needs, geopolitical considerations, fiscal constraints, and population settlement patterns, leading to variability in the number and/or presence of the regions under consideration. Not all regions are represented in every State, a point that is evidenced in the six-State case study series. Nevertheless, RTI standardized the regions depicted in the case series maps to permit useful comparisons across the States. Specific examination of local/regional disaster preparedness would require selection of locally relevant regions that would be employed in the event of likely disaster scenarios or threats in a geographic area.

Template Development

The second step in developing the *Atlas* was to transform discussions about disaster preparedness

regionalization and resource allocation into a set of maps that answered the research questions posed by the project and used available geographic information. RTI staff used information obtained from project meetings to draft a template that laid out graphic elements, including maps, legends, tables, and text. At the same time, data were loaded into the GIS and sample maps were developed for discussion. These drafts were sent to RTI's consultants and the AHRQ Task Order Officer for review. Reviewers were asked to comment on the overall layout of the *Atlas* and whether or not the correct elements were included so that the research questions were properly answered. Additionally, RTI was asked to give a briefing to Dr. Robert Claypool at the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Public Health Emergency Preparedness, on May 12, 2005. RTI staff presented an overview of the study and a set of example maps and discussed possible uses for the *Atlas*. Comments from the briefing were incorporated into the final template.

Once the template was finalized, a design of the template was created in publishing software so that maps and other graphic elements could be imported and laid out for publication. A comprehensive quality check/quality assurance process was put into place to ensure the accuracy of the data and maps in the *Atlas*.

In order to make the *Atlas* compliant with the Americans with Disabilities Act, an appendix was added with tables of data for the 51 State-level maps (50 States and the District of Columbia). (See **Appendix B.**)

READER'S GUIDE

The *Atlas* is organized into four sections:

- Project abstract for *Exploring the Special Needs and Potential Role of Nursing Homes in Surge Capacity for Bioterrorism and Other Public Health Emergencies*
- The *Atlas Overview* (this section)
- A series of six case studies (North Carolina, Oregon, Pennsylvania, Southern California, Utah, and Washington), examining disaster preparedness and coordination, as well as hospital and nursing home location relative to the urban population
- 51 State-level maps (50 States and the District of Columbia) that explore hospital and nursing home location and capacity relative to the urban population

Most maps in this *Atlas* are choroplethic maps in which geographic units (such as counties) are shaded to represent different values of a variable. When the data are continuous in nature (e.g., percentage or ratio), data values are grouped into

several ranges or “classes.” The legends located on each map page list the range of data values that each color represents. These maps are useful when data have been scaled or normalized in some way. When data are nominal in nature, data values are grouped into discrete categories and a different color assigned to each category. The legend located on each map page lists the range of bed sizes that each size symbol represents. Proportional symbols are useful when looking at the location of a facility and comparing its relative size with other facilities in an area. A more detailed description of mapping techniques used to synthesize and display information is provided in **Appendix A, Technical Notes**.

MAPPING, DATA SOURCES, AND SOFTWARE USED

The facilities mapped in this *Atlas* were geocoded, or located on a map, using address information from the American Hospital Association and the Centers for Medicare and Medicaid Services. Data on population characteristics were obtained from the U.S. Census Bureau and aggregated to the census tract or county level. The maps in the *Atlas* were created in ArcView 9 geographic information and mapping software from ESRI. Each of the States was drawn using the State plane map projection. A more detailed discussion on mapping or cartographic methods, data sources, and software used to produce the *Atlas* can be found in **Appendix A, Technical Notes**.

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